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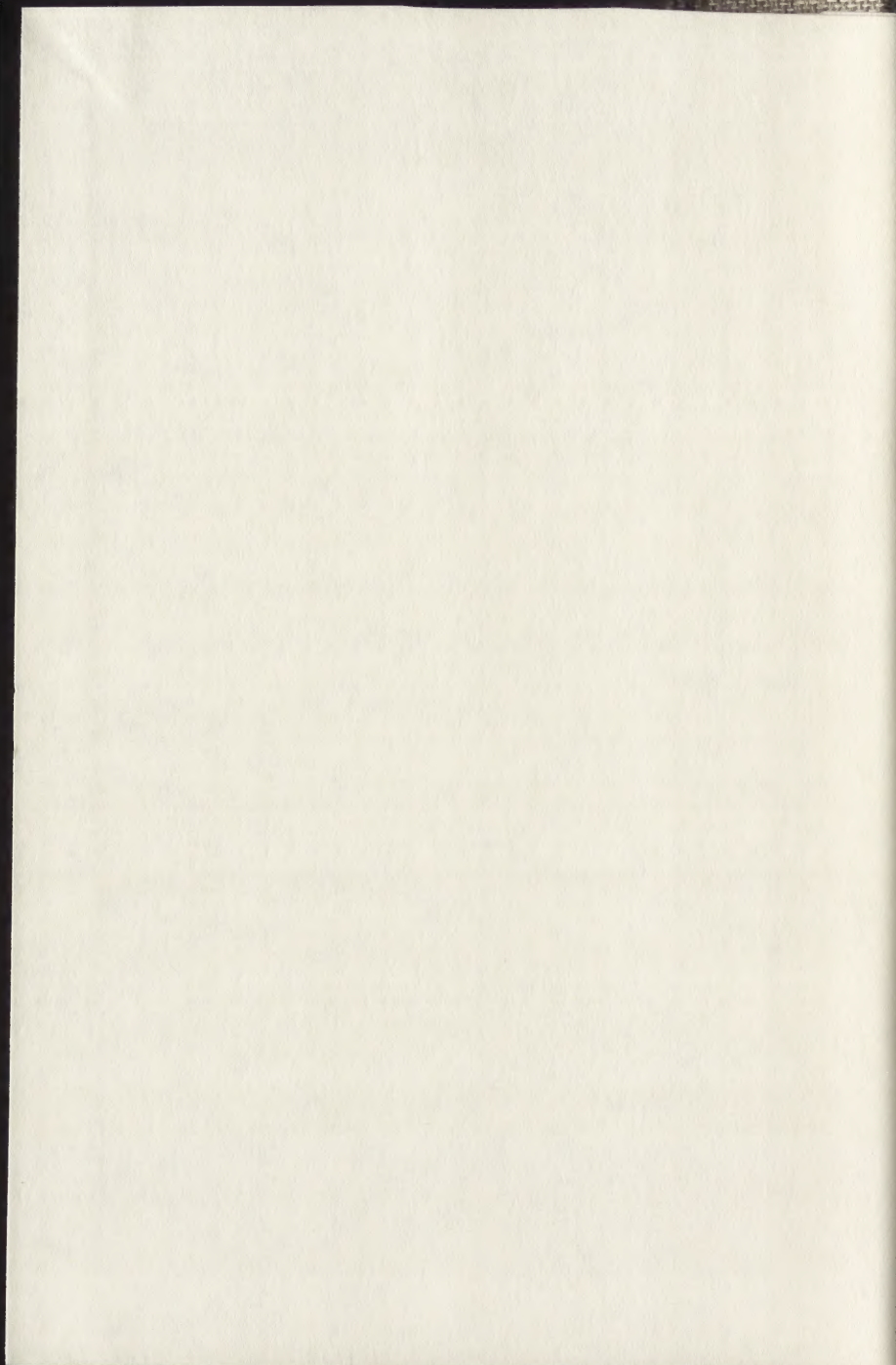
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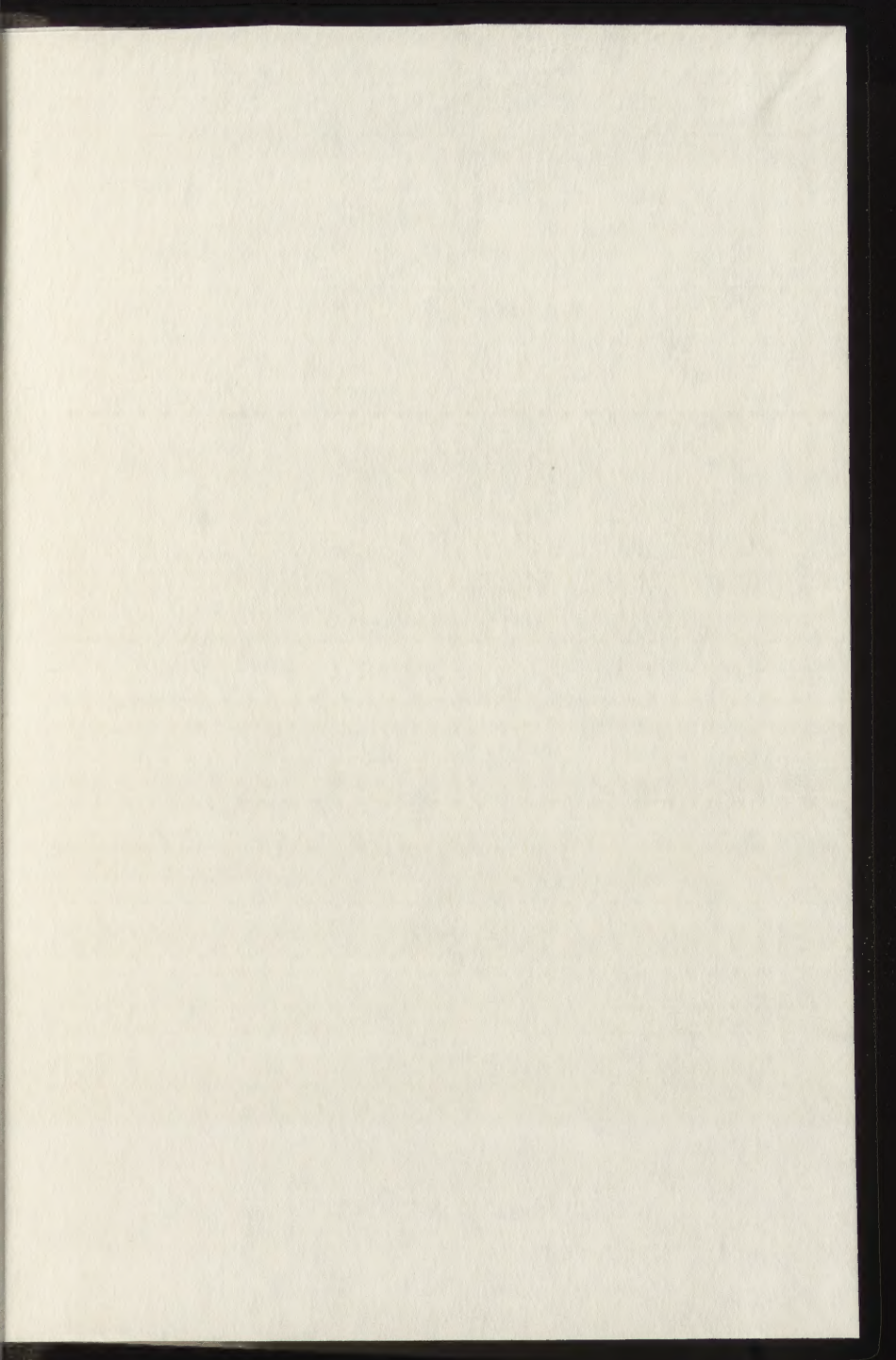
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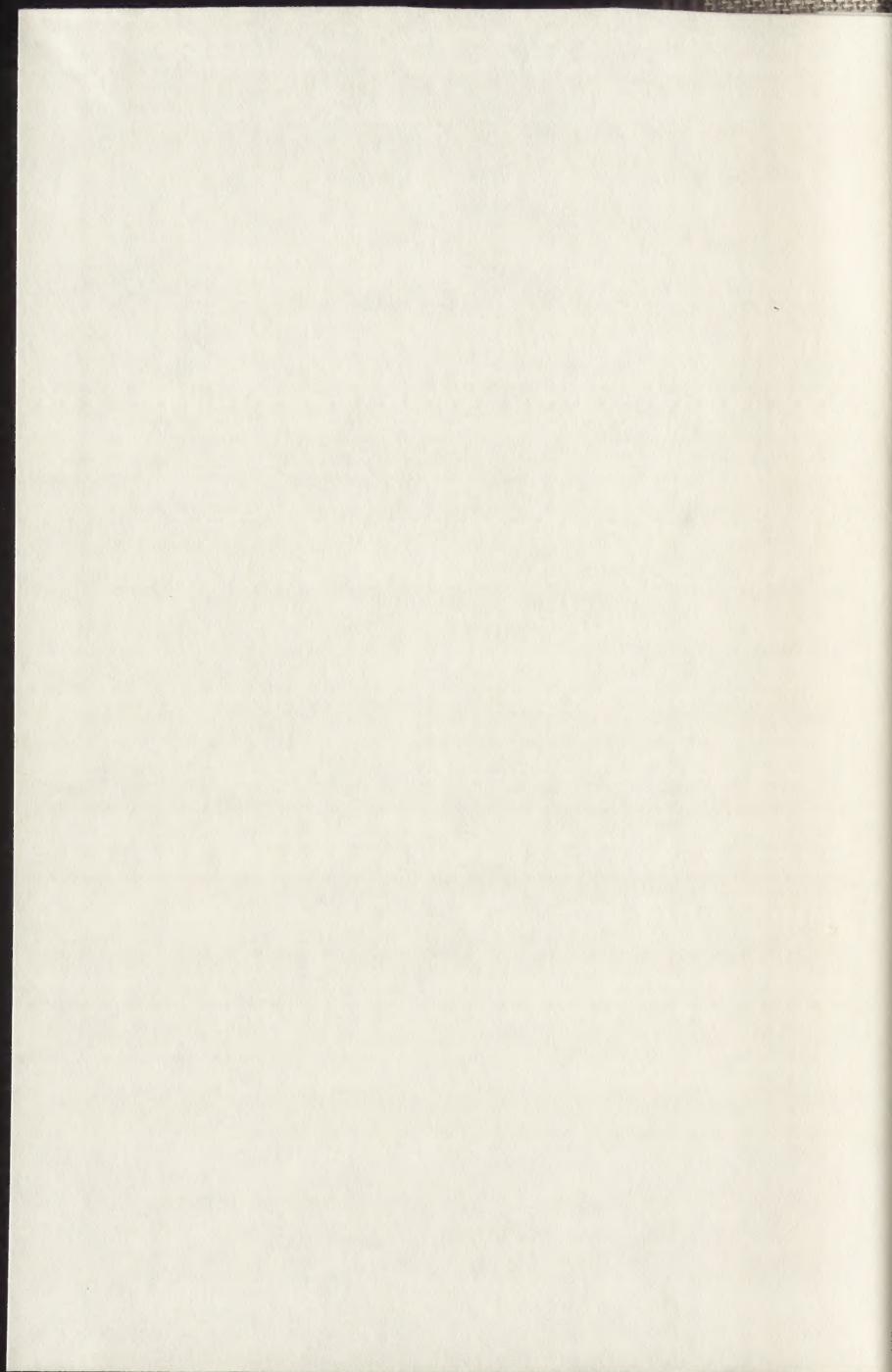
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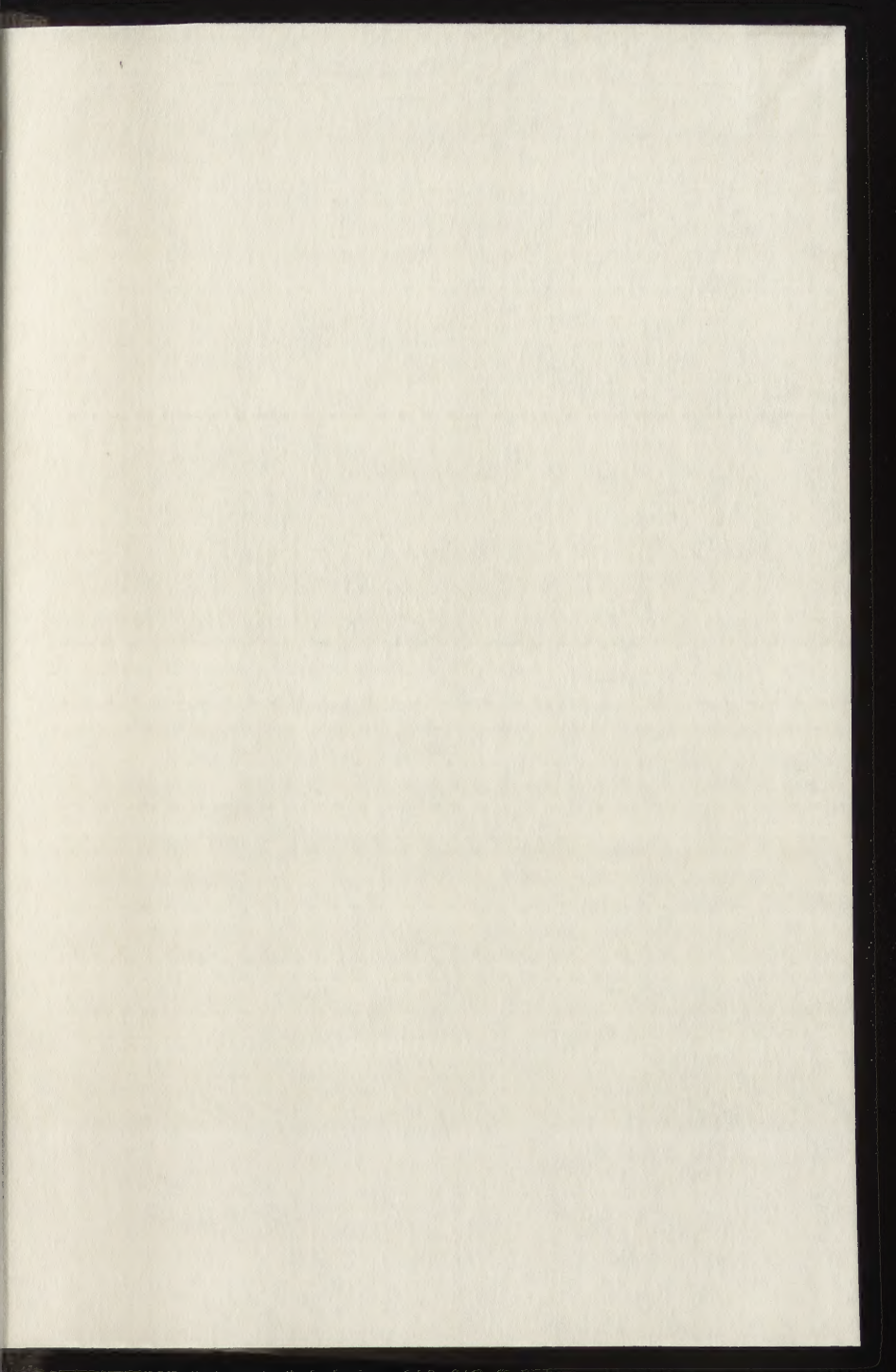


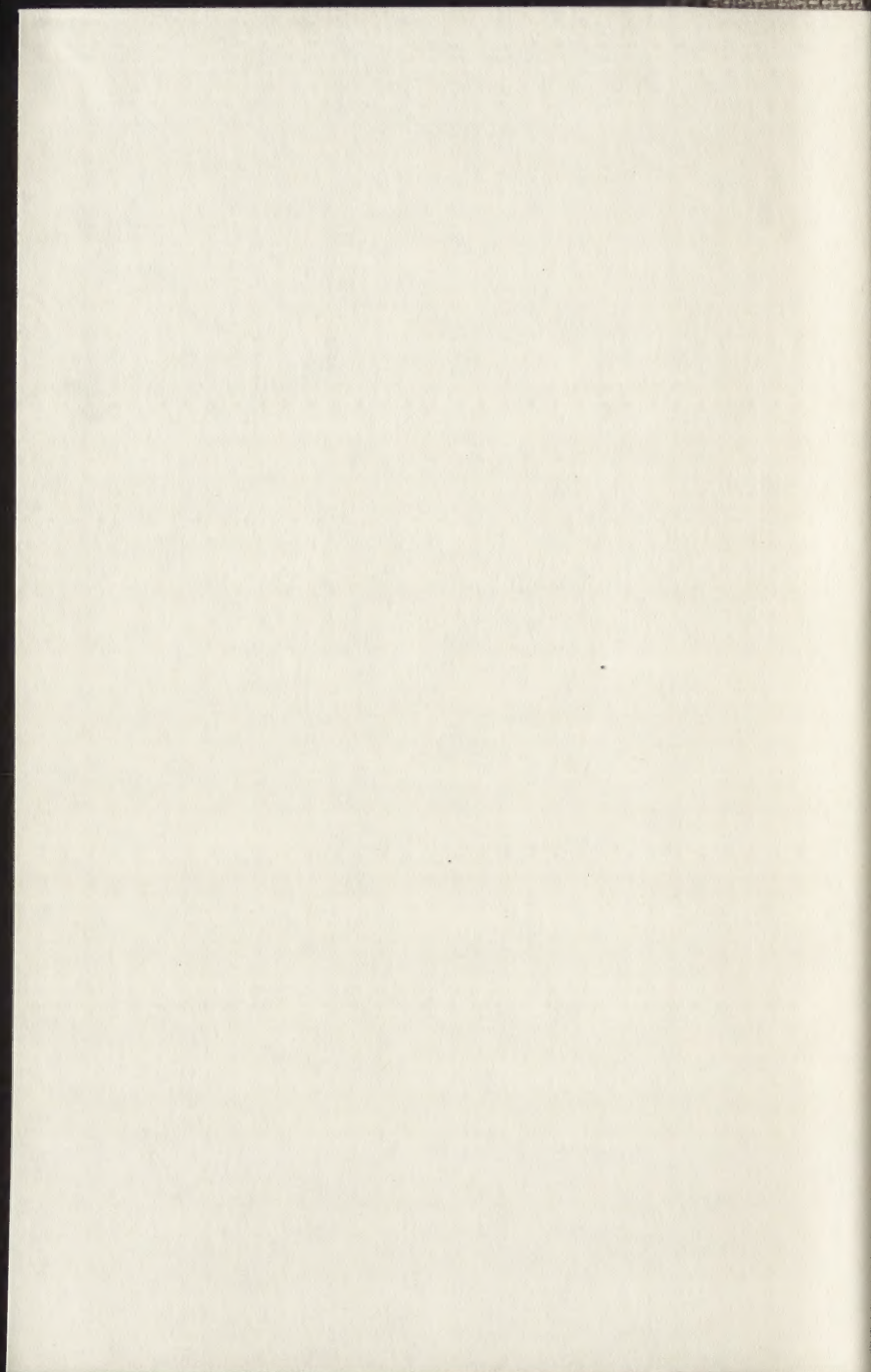




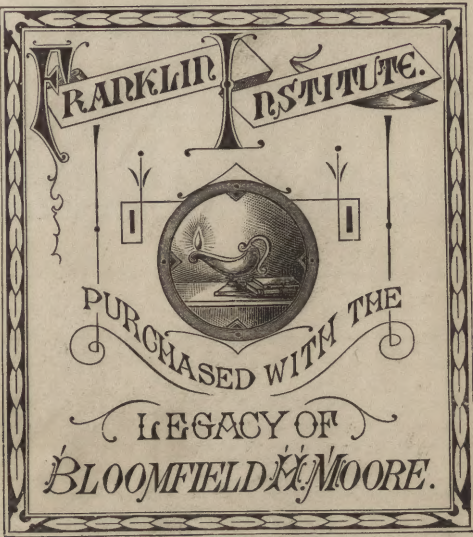


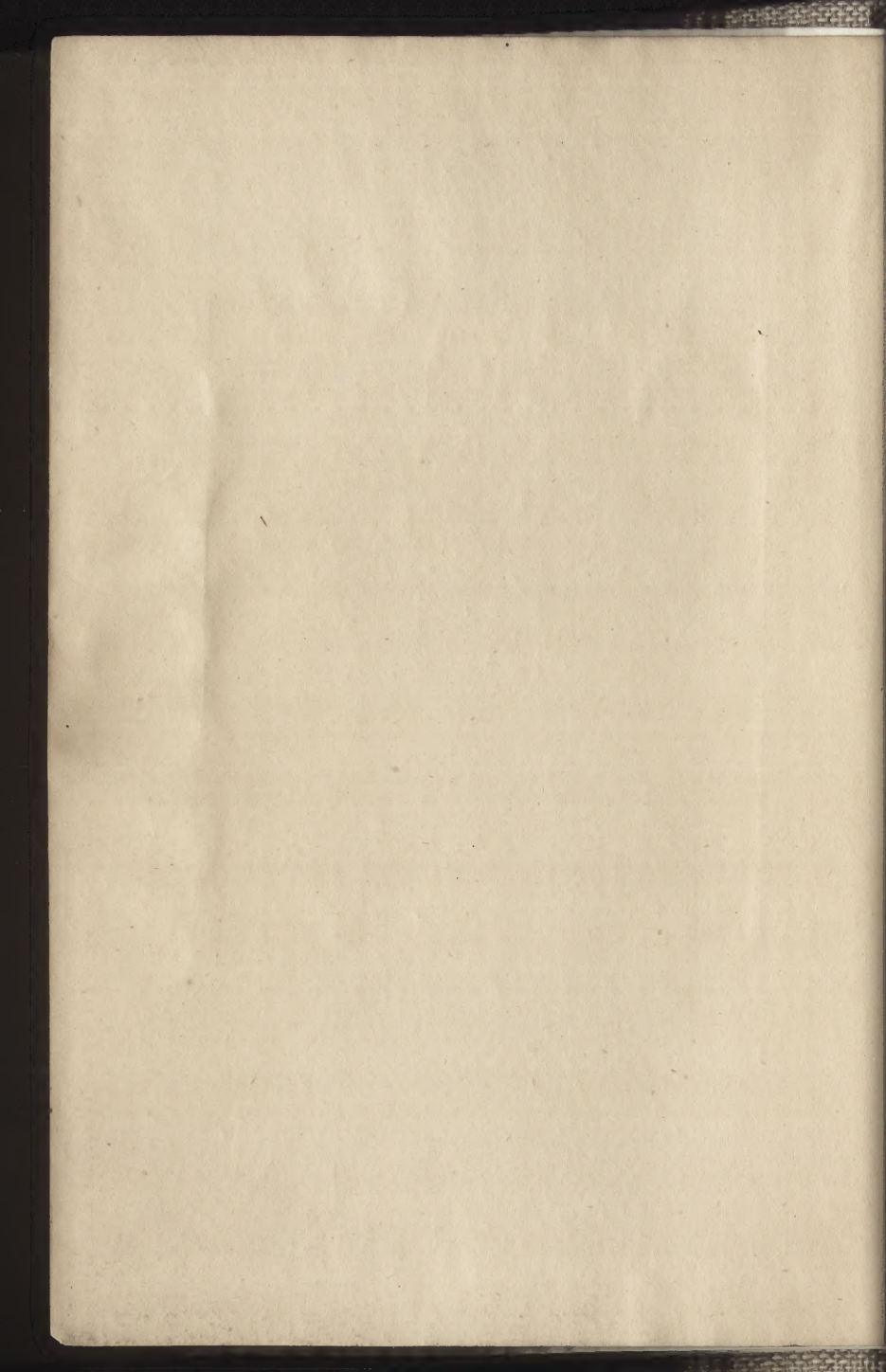






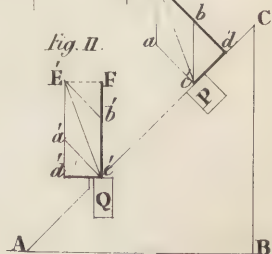
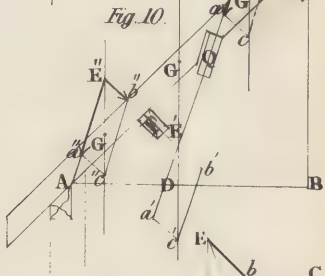
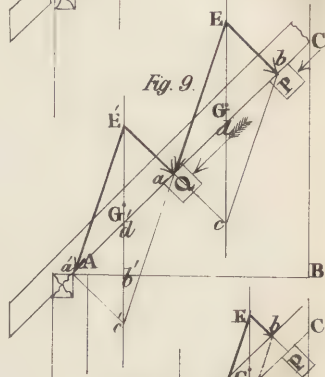
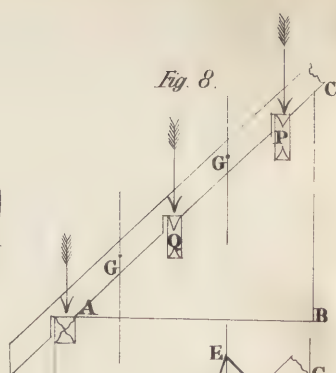
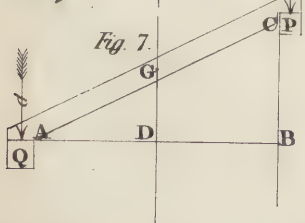
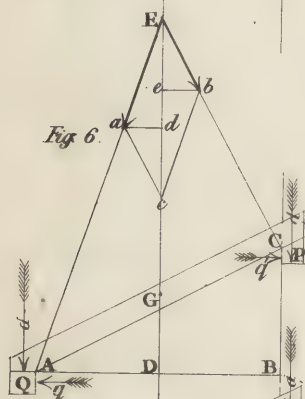
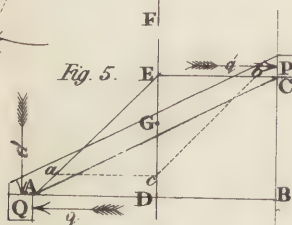
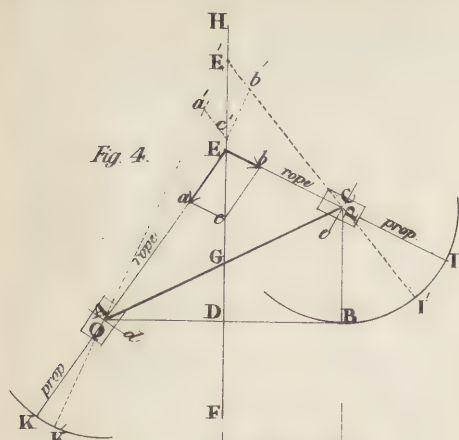












TABLES

OF THE

STRENGTH AND DEFLECTION

OF

TIMBER.

BY WILLIAM LEA,  
*SURVEYOR.*

 LONDON:  
SIMPKIN, MARSHALL & CO., STATIONERS' HALL COURT.  
E. C. OSBORNE, BIRMINGHAM.  
1850.



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## PREFACE.

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THE following tables are constructed for the purpose of determining by inspection, or by simple multiplication and division, the dimensions of any description of timber requisite to carry a given weight, or to have, when loaded, a given deflection. They are designed for the use of Architects, Builders and Carpenters; Engineers, Ship Builders, Surveyors; and others, who may be in any way interested in converting timber into scantlings for building purposes generally, or for otherwise sustaining transversely any given pressures.

The outline of the work may be stated as follows:—

The timber selected as the unit or standard of comparison, is Red Pine of a given strength and elasticity; and the constants for various species of timber are derived from the mean results of an extensive series of Experiments made principally by Professor BARLOW, upon “woods not of the best but more common quality, in order to furnish “data for practical cases,” the specimens for that purpose having been selected from all the timber in store in Woolwich Dock Yard.

For the convenience of reference, and in order to keep the subjects distinct, the work is arranged in four divisions; namely, Three Series of Tables and several Miscellaneous Tables.

By the FIRST SERIES of Tables may be found the Scantlings of Red Pine, and thence by a Table of Constants those of any other description of timber, sufficient to carry given heavy weights, and to have when loaded given deflections.

The SECOND SERIES of Tables of Weights shew one-eighth of the breaking weight in cwts. uniformly loaded, or one-fourth of the same when suspended from the middle, of RED PINE of any usual scantling

not exceeding 32 feet long. At the foot of each table the deflections corresponding to the weights in the tables are given; and by this Series and the Table of Constants to the same, the scantlings of other kinds of timber may be found sufficient to carry, when loaded, any given portion of the breaking weight.

By the THIRD SERIES may be found the scantlings of Red Pine and of other species of timber, when pressed by two forces acting respectively in the directions of the depth and the breadth, so as to have given equal deflections. By this Series, the scantlings for purlins, breast-summings, &c., are found, when pressed by the weight of a roof, or by loaded beams inclined at given angles to the horizontal plane.

MISCELLANEOUS TABLES, &c. The greatest weight in cwts. upon each foot in length of a joist, beam, lintel, &c., being ascertained or given, then by the first of these tables may be found the breadth of the same, for any usual depth or length sufficient to carry, when loaded, any given portion of the breaking weight.

The Second Table shews the deflection of Red Pine scantlings, of any breadth and of any usual depth and length, when loaded with one-fourth of the breaking weight.

By the seven following tables may be determined the depths of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, Binding Joists, &c., from  $1\frac{1}{2}$  inches to 3 inches in breadth, the deflection being  $\frac{1}{40}$  of an inch to the foot when uniformly loaded with the weights given in the tables. At the foot of each of these tables there is a multiplier to each column, by which may be found the breaking weight of every scantling therein. Similar multipliers are given in the First and Third Series; and it may here be remarked, as one of the leading features in the construction of this work, that the breaking weight and the deflection when loaded with the tabular weight, are given for every scantling throughout the whole of the tables.

The tenth and eleventh of the Miscellaneous Tables shew the data upon which the Tables of Constants are founded; and at the end of the work there are several equations with examples, which may be useful in computing the true content of earthwork, to any given slope, in railway cuttings and embankments.



At the foot of each page of the tables there is an explanatory example. The use of the work is further and fully shewn in the various diagrams and practical Examples which precede the tables.

If a joist, beam, lintel, brest-summer, or purlin, uniformly loaded with a given weight, be assumed as a Standard by which to determine the scantlings of other joists, beams, lintels, brest-summer, or purlins, to carry a similar weight; the dimension, or one near to it, of the former will be found in some one of the tables in the First or Third Series; by which table the scantlings for that and other lengths are given, to carry the same weight, and to have the same deflection for each foot in length, as the standard bearing timber so assumed.

As accuracy is of the utmost importance in a work of this description, the Author has spared no pains in carefully revising, correcting, and checking, in several ways, every calculation in the original manuscripts, and from those, the proof sheets; both of which have been again minutely revised.

BIRMINGHAM;  
May, 1850.

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## FIRST SERIES OF TABLES,

By which may be found the Scantlings of any species of Timber sufficient to carry a given weight, and to have with that weight a given deflection.—

	Weight upon each foot in length = W ;		Deflection in the middle for each foot in length = D.	Page.
	In lbs.	In cwts.	In parts of an inch	
Table I. ....	1·000	·0089	... $\frac{1}{40}$ ...	5
Table II. ....	8·000	·0714	... $\frac{1}{40}$ ...	6
Table III. ....	15·625	·1395	... $\frac{1}{40}$ ...	7
Table IV. ....	27·000	·2410	... $\frac{1}{40}$ ...	8
Table V. ....	42·875	·3828	... $\frac{1}{40}$ ...	9
Table VI. ....	64·000	·5714	... $\frac{1}{40}$ ...	10
Table VII. ....	91·125	·8136	... $\frac{1}{40}$ ...	11
Table VIII. ....	125·000	1·1160	... $\frac{1}{40}$ ...	12
Table IX. ....	166·375	1·4854	... $\frac{1}{40}$ ...	13
Table X. ....	216·000	1·9285	... $\frac{1}{40}$ ...	14
Table XI. ....	274·625	2·4520	... $\frac{1}{40}$ ...	16
Table XII. ....	343·000	3·0625	... $\frac{1}{40}$ ...	18
Table XIII. ....	421·875	3·7667	... $\frac{1}{40}$ ...	20
Table XIV. ....	512·000	4·5714	... $\frac{1}{40}$ ...	22
Table XV. ....	648·000	5·7857	... $\frac{1}{35}$ ...	24
Table XVI. ....	800·000	7·1428	... $\frac{1}{35}$ ...	26
Table XVII. ....	968·000	8·6428	... $\frac{1}{35}$ ...	28
Table XVIII. ....	1152·000	10·2857	... $\frac{1}{60}$ ...	30
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Table XX. ....	1568·000	14·0000	... $\frac{1}{70}$ ...	34
Table XXI. ....	1800·000	16·0714	... $\frac{1}{75}$ ...	36
Table XXII. ....	2048·000	18·2857	... $\frac{1}{80}$ ...	38
Table XXIII. ....	2312·000	20·6428	... $\frac{1}{85}$ ...	40
Table XXIV. ....	2592·000	23·1428	... $\frac{1}{90}$ ...	42
Table XXV. ....	2888·000	25·7857	... $\frac{1}{95}$ ...	44
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## FIRST SERIES OF TABLES,

By which may be found the Scantlings of any species of Timber sufficient to carry a given weight, and to have with that weight a given deflection.—

TABLE	Weight uniformly loaded. Value of $\frac{W}{D}$ ;			Weight suspended from the middle. Value of $\frac{W'}{D}$ ;			Page.
	In lbs.	In cwt.	In tons	In lbs.	In cwt.	In tons.	
I. ....	40	·35	·017	25	·23	·011	5
II. ...	320	2·85	·142	200	1·78	·089	6
III. ...	625	5·58	·279	390	3·48	·174	7
IV. ...	1080	9·64	·482	675	6·02	·301	8
V. ....	1715	15·31	·765	1071	9·57	·478	9
VI. ...	2560	22·85	1·142	1600	14·28	·714	10
VII. ...	3645	32·54	1·627	2278	20·34	1·017	11
VIII. .	5000	44·64	2·232	3125	27·90	1·395	12
IX. ...	6655	59·41	2·970	4159	37·13	1·856	13
X. ...	8640	77·14	3·857	5400	48·21	2·410	14
XI. ...	10955	98·08	4·904	6865	61·30	3·065	16
XII....	13720	122·50	6·125	8575	76·56	3·828	18
XIII. .	16875	150·67	7·533	10546	94·16	4·708	20
XIV. .	20480	182·85	9·142	12800	114·28	5·714	22
XV. ...	29160	260·35	13·017	18225	162·72	8·136	24
XVI. .	40000	357·14	17·857	25000	223·21	11·160	26
XVII..	53240	475·35	23·767	33275	297·09	14·854	28
XVIII.	69120	617·14	30·857	43200	385·71	19·285	30
XIX. .	87880	784·64	39·232	54925	490·40	24·520	32
XX....	109760	980·00	49·000	68600	612·50	30·625	34
XXI. .	135000	1205·35	60·267	84375	753·34	37·667	36
XXII.	163840	1462·85	73·142	102400	914·28	45·714	38
XXIII.	196520	1754·64	87·732	122825	1096·65	54·832	40
XXIV.	233280	2082·85	104·142	145800	1301·78	65·089	42
XXV.	274360	2449·64	122·482	171475	1531·02	76·551	44
XXVI.	320000	2857·14	142·857	200000	1785·71	89·285	46

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Shewing ONE-EIGHTH of the breaking weight of RED PINE uniformly loaded, or ONE-FOURTH of the same when suspended from the middle of any Scantling, of the various Depths in the tables.—

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### THIRD SERIES OF TABLES,

By which may be found the Scantlings of any species of Timber, sufficient to have any given deflections, when acted upon by two forces P and Q; viz., P in the direction of the depth, Q in the direction of the breadth; the deflections each way of the timber being equal.—

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# CONSTRUCTION OF THE TABLES.

## EQUATIONS BY WHICH THE TABLES ARE CALCULATED.

Throughout the Tables, the standard values of S and E for Red Pine are,—

$$S = \frac{1W}{4bd^2} = 1344.$$

$$E = \frac{E^3W}{32bd^3\delta} = 230000.$$

If the weight W be uniformly loaded, and L be the length in feet, we have

$$d = \sqrt[3]{\left\{ \frac{27}{184000} \times \frac{W}{b\delta} \right\} \times L} \dots\dots\dots(1);$$

and if W = weight in lbs. upon each foot in length, and  $\delta = \frac{1}{40}$  of an inch to the foot,

$$d = \sqrt[3]{\left\{ \frac{27}{4600} \times \frac{W}{b} \right\} \times L} \dots\dots\dots(2):$$

by which equation Tables I. to XXVI. in the FIRST SERIES are calculated.

In equation (2), W is assumed successively as follows, viz.:

Tables I. to XIV. ....  $1^3$ ;  $2^3$ ;  $2.5^3$ ;  $3^3$ ;  $3.5^3$ ; .....  $7.5^3$ ;  $8^3$ ; and in Tables XV. to XXVI.,  $9^3$ ;  $10^3$ ;  $11^3$ ;  $12^3$ ;  $13^3$ ; .....  $19^3$ ;  $20^3$ ;

the depths throughout the tables for the same values of  $b$  and  $L$  are therefore in arithmetical progression.

In the Tables, the weight in lbs. upon each foot in length is, in Tables I. to XIV., as above, viz  $1^3$ ;  $2^3$ ;  $2.5^3$ ;  $3^3$ ; .....  $7.5^3$ ;  $8^3$ ; and in Tables XV. to XXVI.,  $9^3 \times 40 \times \delta'$ ;  $10^3 \times 40 \times \delta'$ ; .....  $20^3 \times 40 \times \delta'$ ; in which  $\delta' = \frac{1}{45}$ ;  $\frac{1}{50}$ ; .....  $\frac{1}{100}$ , respectively.

Since the breaking weight in lbs., uniformly loaded, of a scantling of the standard strength 1344, is  $\frac{896bd^2}{L} = (\text{suppose}) M \times W \times L$ , we have

$$M = \frac{896bd^2}{WL^2} \dots\dots\dots(3).$$

Substituting in (3), the value of  $d$  in (2), we have  $M = c' \times \sqrt[3]{\frac{b}{W}}$ ; therefore the multipliers  $M$  are independent of  $d$  and  $L$ .

In Tables I. to XIV.,  $M$  for the same value of  $b$  is in arithmetical progression, and in Tables XIV. to XXVI. constant throughout.

## THIRD SERIES OF TABLES.

Let  $P$  = pressure,  $\delta$  = deflection in the direction of the depth;

Let  $Q$  = pressure,  $\delta'$  = deflection in the direction of the breadth;  
then from (1)

$$d = \sqrt[3]{\left\{ c \times \frac{P}{b\delta} \right\}} \times L,$$

$$b = \sqrt[3]{\left\{ c \times \frac{Q}{d\delta'} \right\}} \times L;$$

from which we have

$$d = c^{\frac{1}{4}} \left\{ \frac{P^3\delta'}{Q\delta^3} \right\}^{\frac{1}{8}} \times L^{\frac{3}{4}} \dots\dots\dots (4),$$

$$\begin{aligned} b &= c^{\frac{1}{4}} \left\{ \frac{Q^3\delta}{P\delta'^3} \right\}^{\frac{1}{8}} \times L^{\frac{3}{4}} \\ &= \left( \frac{Q\delta}{P\delta'} \right)^{\frac{1}{2}} \times d \end{aligned} \dots\dots\dots (5):$$

which are general equations for determining the scantlings to have *any* given deflections.

If  $\delta = \delta'$ ; and  $Q = n.P$ ;

$$d = \left( \frac{cPL^3}{\delta} \right)^{\frac{1}{4}} \times \left( \frac{1}{n} \right)^{\frac{1}{8}} \dots\dots\dots (6),$$

$$b = \sqrt{n} \times d \dots\dots\dots (7);$$

by which equations the 6 Tables in the THIRD SERIES are calculated;  
 $c$  being =  $\frac{27}{46000}$ ;  $P$  = pressure in lbs. upon each foot in length; and  
 $\delta = \frac{1}{40}$  of an inch to the foot, as before.

$P$  in (6), is assumed as are the terms of the progression,

$$1^4; 2^4; 2.5^4; 3^4; 3.5^4; 4^4; 4.5^4; 5^4; \dots\dots\dots 9.5^4; 10^4.$$

In the Tables, in Cols. I. to VI.,  $P = 1^4; 2^4; 2.5^4; 3^4; 3.5^4; 4^4$ ;  
and in Cols. VII. to XVIII.,

$$P = 4.5^4 \times 40 \times \delta'; \quad 5^4 \times 40 \times \delta'; \dots\dots 10^4 \times 40 \times \delta';$$

$$\text{in which } \delta' = \frac{1}{45}; \quad \frac{1}{50}; \quad \dots\dots\dots \frac{1}{100} \text{ as before.}$$

Substituting the values of  $d$  and  $b$  in (6) and (7), in the equation  
 $M = \frac{896bd^2}{PL^2}$ , the multipliers  $M$  are evidently independent of  $b$  and  $d$ ;  
and in Cols. VI. to XVIII. constant for the same length.



THE SECOND SERIES OF TABLES is calculated by the equation  $W = \frac{bd^2}{L}$ , = one-fourth of the breaking weight in cwts., suspended from the middle. .... (8).

In the MISCELLANEOUS TABLES,

Table I. is calculated by the equation  $b = \frac{L^2}{8d^2}$  ..... (9).

Table II. „ by „  $\delta = .03287 \times \frac{L^2}{d}$  ... (10).

Tables III. to IX. inclusive, are formed from and by interpolating the First Series of Tables.

### THEOREM.

(Corollary from Equations, page xiii.)

Let  $W$  = one-fourth of the breaking weight, uniformly loaded, of a scantling of the strength 1344, of which the length in feet is  $L$ , and depth in inches  $d$ .

$L\delta$  = deflection of the same, when uniformly loaded with the weight  $W'$ .

$c$  = deflection of a scantling 1 inch square and 1 foot long of the same strength, when uniformly loaded with one-fourth of the breaking weight: which for Red Pine is  $c = \frac{1.89}{5750}$ .

We have then the following relation, viz.:

$$\text{When } W' = W, \quad L = \frac{d\delta}{c} \dots\dots\dots (\text{A}).$$

For Red Pine  $L = 30.423 \times d\delta$ .

If  $d = 14''$  and  $\delta = \frac{1}{40}''$ , then  $L = 10.648$ .

Therefore, if a Red Pine beam be 14 inches deep, and less than 10 feet 7.77 inches long, the weight which produces a deflection of  $\frac{1}{40}$  of an inch to the foot, exceeds one-fourth of the breaking weight.



## DESCRIPTION AND USE OF THE TABLES.

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THE outline of this work is described in the Preface, and the further description and use of the tables are shewn by the following Examples.

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### THE FIRST SERIES OF TABLES,

By which and the Table of Constants No. 1, may be found the Scantlings of any description of Timber sufficient to carry a given weight, and to have with that weight a given deflection.

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The greatest weight upon a joist beam or lintel being ascertained or given, and the deflection when loaded with that weight *assumed*, the scantlings are found by the First Series of Tables.

The weight being ascertained, if the tabular deflection be that assumed, the scantlings are given by inspection of the tables.

If the assumed deflection be greater or less than the tabular deflection, the scantlings are found by means of the expression  $\frac{W}{D}$ , at the head of each table. In this case it will be requisite to fix upon the least breaking weight of the required scantling, and then by the multipliers and weights in the table find the breaking weights of the scantlings, as in Examples 4 and 6.

When the weight or the value of  $\frac{W}{D}$  falls between two of the tables, the depth may be found as in Example 1.

In the following Examples,

W = weight in lbs., cwt.s., or tons; either upon each foot in length, uniformly loaded, or suspended from the middle, as the case may be; and

D = deflection in inches or parts of an inch.

If W = weight upon each foot in length, then

D = deflection for each foot in length.

If W = weight either uniformly loaded or suspended from the middle, then

D = deflection in the middle of the scantling.

c = constant in any column in the Tables of Constants, No. 1, 2 and 3.

*To find the Scantlings of Red Pine sufficient to carry a given weight UNIFORMLY LOADED, and to have with that weight a given deflection.*

*Example 1.*—Required the Scantlings of Red Pine 14 feet long sufficient to carry a weight of 800 lbs. to the foot, or 100 cwts. uniformly loaded upon the beam, the deflection to be as given by the tables.

The scantlings are given by Table XVI.

If the breadth be 8 inches, the depth is 12·63 inches, and the deflection is  $\frac{1}{8}$  of an inch.

If the weight be 968 lbs. to the foot, or 121 cwts. uniformly loaded upon the beam, the scantlings are given by Table XVII.

If the breadth be 8 inches, the depth is 13·89 inches, and the deflection is  $\frac{1}{8}$  of an inch.

Therefore,

For 100 cwts. uniformly loaded, the Scantling is 12·63 × 8; say 13 × 8.

For 121 cwts. uniformly loaded, the Scantling is 13·89 × 8; say 14 × 8.

And for those and intermediate weights the Scantlings are,

$$13 \times 8; 13\frac{1}{2} \times 8; \text{ or } 14 \times 8.$$

The same also are the scantlings for weights varying from 62·50 cwts. to 75·62 cwts. suspended from the middle.

*Example 2.*—The greatest weight, uniformly loaded upon a Red Pine joist of any length, is 144 lbs. to the foot. Required the Scantlings which with that weight deflect  $\frac{1}{8}$  of an inch to the foot.

$$W = 144 \text{ lbs.} \quad D = \frac{1}{8}.$$

$$\frac{W}{D} = \frac{144}{\frac{1}{8}} = 144 \times 8 = 1152 \text{ lbs. uniformly loaded.}$$

The Scantlings are given by Table X., and every scantling therein with 144 lbs. weight to the foot uniformly loaded, deflects in the middle  $\frac{1}{8}$  of an inch to the foot.

*Example 3.*—Required the size of the Joists and Beams for a Warehouse Floor upon the following data:—

*Data for the Joists.*

Joists distant apart from middle to middle, 14½ inches;

Greatest load upon the floor, 3 cwt. per superficial foot;

Deflection when loaded,  $\frac{1}{8}$  of an inch to the foot.



The weight upon each foot in length of a joist is  $\frac{3 \times 14.5}{12} = 3.625$  cwt.

$$W = 3.625 \text{ cwt.} \quad D = \frac{1}{50}.$$

$$\frac{W}{D} = \frac{3.625}{\frac{1}{50}} = 3.625 \times 50 = 181.25 \text{ cwt. uniformly loaded.}$$

The scantlings are given by Table XIV.

If the length of the joists be 7 feet, the scantlings are,—

$$\dots 8.02 \times 2; 7.71 \times 2\frac{1}{4}; 7.44 \times 2\frac{1}{2}; 7 \times 3; 6.65 \times 3\frac{1}{4}; \&c.$$

Deflection  $\frac{2}{30}$  of an inch.

If the length of the joists be 8 feet, the scantlings are,—

$$\dots 9.16 \times 2; 8.81 \times 2\frac{1}{4}; 8.51 \times 2\frac{1}{2}; 8 \times 3; 7.60 \times 3\frac{1}{4}; \&c.$$

Deflection  $\frac{2}{30}$  of an inch.

And so on for other lengths.

#### *Data for the Beams.*

Beams distant apart from middle to middle, 8 feet;

Weight upon each foot in length,  $8 \times 3 = 24$  cwt.;

Deflection,  $\frac{1}{40}$  of an inch to the foot.

---


$$W = 24 \text{ cwt.} \quad D = \frac{1}{40}.$$

$$\frac{W}{D} = \frac{24}{\frac{1}{40}} = 24 \times 40 = 960 \text{ cwt. uniformly loaded.}$$

By Table XX.,  $\frac{W}{D} = 980$  cwt. uniformly loaded: the scantlings are given by that table.

If the length of the beams clear of the supports be 12 feet, the scantlings are,—

$$\dots 15.15 \times 8; 14.57 \times 9; 14.07 \times 10; 13.63 \times 11; 13.24 \times 12; \&c.$$

The weight upon each of the beams is  $12 \times 24 = 288$  cwt. And if  $14.07 \times 10$  be the size of the beams, the breaking weight of each beam by Table XX. is  $7.85 \times 168 = 1318.8$  cwt.

$$\text{And } \frac{1318.8}{288} = 4.57.$$

That is, about  $4\frac{1}{2}$  times the weight upon the floor is the breaking weight of the beams; the deflection of each beam with 288 cwt. uniformly loaded is  $\frac{1}{40}$  or  $\frac{3}{100}$  of an inch.

*Example 4.*—Required the Scantlings of Red Pine sufficient to carry  $7\frac{1}{2}$  tons, or 150 cwt., uniformly loaded; and deflect with that weight  $\frac{1}{8}$  of an inch. The breaking weight to be not less than  $4 \times 150 = 600$  cwt.

$$W = 7.5 \text{ tons.} \quad D = \frac{1}{8}.$$

$$\frac{W}{D} = \frac{7.5}{\frac{1}{8}} = 7.5 \times 8 = 60 \text{ tons, uniformly loaded.}$$

The scantlings are given by Table XXI.

If the length clear of the supports be 6 feet, the Scantlings are,—

$$\dots\dots 9.49 \times 5; 8.93 \times 6; 8.49 \times 7; \dots\dots 6.58 \times 15.$$

Here the first six scantlings in the table are rejected, because the breaking weight of each is less than 600 cwt.

The breaking weight of  $9.49 \times 5$ , is  $6.231 \times 96.42 = 600.79$  cwt. A joist  $9\frac{1}{2} \times 5$ , contains the least quantity of timber, and is the weakest of the 11 scantlings in the table to be selected from, to fulfil the above conditions.

*Example 5.*—Required the depth of a lintel to carry a 14-inch brick wall 20 feet high over an 8-foot opening; the lintel to deflect in the middle  $\frac{1}{8}$  of an inch.

Suppose the weight of 1 cubic foot of brickwork to be 125 lbs. or 1.115 cwt., then the weight upon the lintel is,—

$$8 \times 20 \times \frac{14}{12} \times 1.115 = 208.13 \text{ cwt.}$$

$$W = 208.13 \text{ cwt.} \quad D = \frac{1}{8}.$$

$$\frac{W}{D} = \frac{208.13}{\frac{1}{8}} = 208.13 \times 8 = 1665.04 \text{ cwt. uniformly loaded.}$$

The breadth being 14 inches, the depth by Table XXIII. is 10.18 inches.

If the lintel carry the ends of a floor of joists 16 feet in length, and if the greatest weight upon the floor be 1.5 cwt. per superficial foot, the additional weight upon the lintel is  $8 \times 1.5 \times 8 = 96$  cwt.

$$W = 208.13 + 96 = 304.13 \text{ cwt.} \quad D = \frac{1}{8}, \text{ as before.}$$

$$\frac{W}{D} = \frac{304.13}{\frac{1}{8}} = 304.13 \times 8 = 2433.04 \text{ cwt. uniformly loaded.}$$

The breadth being 14 inches, the depth by Table XXV. is 11.38 inches.

To find the Scantlings of Red Pine sufficient to carry a given weight SUSPENDED FROM THE MIDDLE, and to have with that weight a given deflection.

*Example 6.*—Required the Scantlings of Red Pine sufficient to carry  $7\frac{1}{2}$  tons or 150 cwt. suspended from the middle, and deflect with that weight  $\frac{1}{30}$  of an inch. The breaking weight to be not less than  $4 \times 150 = 600$  cwt.

$$W = 7.5 \text{ tons.} \quad D = \frac{1}{30}.$$

$$\frac{W}{D} = \frac{7.5}{\frac{1}{30}} = 75 \text{ tons suspended from the middle.}$$

The scantlings are given by Table XXV.

If the length clear of the supports be 7 feet, the Scantlings are,—

$$\dots\dots 12.54 \times 7; 12.00 \times 8; 11.53 \times 9; 11.14 \times 10; \&c.$$

The first five scantlings in the table are rejected, because the breaking weight of each is less than 600 cwt.

The breaking weight suspended from the middle of Red Pine 7 feet long  $12.54 \times 7$ , is  $5.576 \times 112.81 = 629$  cwt.; the scantlings are  $12\frac{1}{2} \times 7$ ,  $12 \times 8$ ,  $11\frac{1}{2} \times 9$ , &c.

*Example 7.*—Required the Scantlings of Red Pine 14 feet long sufficient to carry 1260 lbs. or 11.25 cwt. or .5625 tons suspended from the middle, and deflect  $\frac{7}{30}$  of an inch.

$W = 1260$  lbs.; or 11.25 cwt.; or .5625 tons; as the case may be.

$$D = \frac{7}{30}.$$

$$\left. \begin{aligned} \frac{W}{D} &= \frac{1260}{\frac{7}{30}} = \frac{1260 \times 30}{7} = 5400 \text{ lbs.} \\ \frac{W}{D} &= \frac{11.25}{\frac{7}{30}} = \frac{11.25 \times 30}{7} = 48.21 \text{ cwt.} \\ \frac{W}{D} &= \frac{.5625}{\frac{7}{30}} = \frac{.5625 \times 30}{7} = 2.41 \text{ tons} \end{aligned} \right\} \text{ suspended from the middle.}$$

The Scantlings are given by Table X. viz. :—

$$\dots\dots 12.03 \times 2; 11.57 \times 2\frac{1}{4}; 11.16 \times 2\frac{1}{2}; 10.51 \times 3; 9.98 \times 3\frac{1}{2}; 9.54 \times 4; 9.18 \times 4\frac{1}{2}; 8.86 \times 5; 8.34 \times 6; 7.92 \times 7; 7.58 \times 8; 7.28 \times 9; 7.03 \times 10; 6.81 \times 11; 6.62 \times 12.$$

Deflection of each of the scantlings with the above weights,  $\frac{7}{30}$  of an inch.

*To find the Scantlings of any Species of Timber to have the same strength or deflection as those of Red Pine of a given length.*

The dimensions of Red Pine being given, the depth or breadth of other species of timber to have the same strength as Red Pine are found by Columns 2 and 3, and to have the same deflections by Col. 5 and 6, in the Table of Constants No. 1, page 2.

*Examples to the Table of Constants, No. 1.*

Let it be required to find, by way of Example, the depth or breadth of *Riga Fir* 10 feet long, to have the same strength and elasticity as Red Pine 10 feet long 10 in. by 3 in.

*Weight, Depth, and Breadth, to have the same strength.*

By the Second Series of Tables, p. 70, the breaking weight of Red Pine 10 feet long 10 in. by 3 in., is  $4 \times 30 = 120$  cwts. suspended from the middle.

*Example to Column I. p 2.*

Relative strength: Red Pine 1·0000; *Riga Fir* ·8029.

$$120 \times \cdot 8029 = 96\cdot348 \text{ cwts.}$$

The breaking weight of *Riga Fir* 10 feet long  $10 \times 3$ , is 96·348 cwts. suspended from the middle.

*Example to Col. II.*

Depth to have the same strength: Red Pine 1·000; *Riga Fir* 1·116.

$$10 \times 1\cdot116 = 11\cdot16 \text{ inches.}$$

The breaking weight of *Riga Fir* 10 feet long  $11\cdot16 \times 3$ , is 120 cwts. suspended from the middle.

*Example to Col. III.*

Breadth to have the same strength: Red Pine 1·000; *Riga Fir* 1·245.

$$3 \times 1\cdot245 = 3\cdot735 \text{ inches.}$$

The breaking weight of *Riga Fir* 10 feet long  $10 \times 3\cdot74$ , is 120 cwts. suspended from the middle.



*Minimum, Mean, and Maximum Strength.*

By Table X. p. 146, the mean results of 71 Experiments upon various species of timber are,—

Minimum strength, ..... ·897.

Mean strength,..... 1·000.

Maximum strength,..... 1·077.

If the greatest variation in the strength of sound timber of the *same species* be 10 per cent. *below*, and 8 per cent. *above*, the mean strength, the depth and breadth for those strengths are given by Cols. II. and III. p. 2.

Thus, if  $10 \times 3$  be the scantling for the mean strength,

then  $10 \cdot 54 \times 3$  or  $10 \times 3 \cdot 33$  are the scantlings for the minimum strength;

and  $9 \cdot 62 \times 3$  or  $10 \times 2 \cdot 78$  are the scantlings for the maximum strength.

*Breadth, Depth, and Weight, to have the same deflection.*

By the Second Series of Tables, p. 70, Red Pine 10 feet long 10 in. by 3 in., with 30 cwts. uniformly loaded, deflects ·164 of an inch.

*Example to Col. IV.*

Relative elasticity: Red Pine 1·000; Riga Fir 1·6033.

$$\cdot 164 \times 1 \cdot 6033 = \cdot 263 \text{ of an inch.}$$

Riga Fir 10 feet long  $10 \times 3$ , with 30 cwts. uniformly loaded, deflects ·263 of an inch.

The weight and depth being the same, the breadth varies as the elasticity.

$$3 \times 1 \cdot 6033 = 4 \cdot 8099 \text{ inches.}$$

Riga Fir 10 feet long  $10 \times 4 \cdot 81$ , with 30 cwts. uniformly loaded, deflects ·164 of an inch.

*Example to Col. V.*

Depth to have the same deflection: Red Pine 1·000; Riga Fir 1·170.

$$10 \times 1 \cdot 170 = 11 \cdot 70 \text{ inches.}$$

Riga Fir 10 feet long  $11 \cdot 70 \times 3$ , with 30 cwts. uniformly loaded, deflects ·164 of an inch.

*Example to Col. VI.*

Weight to have the same deflection; Red Pine 1·000; Riga Fir ·623.

$$30 \times \cdot 623 = 18 \cdot 69 \text{ cwts.}$$

Riga Fir 10 feet long  $10 \times 3$ , with 18·69 cwts. uniformly loaded, deflects ·164 of an inch.

## EXAMPLES TO THE SECOND SERIES OF TABLES.

## TABLE OF CONSTANTS No. 2, p. 50.

By this and the Second Series of Tables may be found the Scantlings of various Species of Timber, sufficient to carry when loaded, any given portion of the breaking weight. By the same tables also may be found the DEFLECTION and BREAKING WEIGHT of any scantling of timber of the several species therein specified.

*To find the breaking weight of any Species of Timber of any dimension in the Second Series of Tables.*

*When the weight is uniformly loaded.*

The value of  $c$  in Col. I. p. 50, multiplied by the tabular weight for the scantling in the Second Series of Tables gives the breaking weight.

*Example 8.*—Required the breaking weight, uniformly loaded, of Riga Fir 16 feet long 12 in. by 8 in.

By Col. I. p. 50, for Riga Fir;  $c = 6.423$ .

By Table XIII. p. 76, the tabular weight for 16 feet long  $12 \times 8$ , is 72 cwts.

$6.423 \times 72 = 462.45$  cwts.; the breaking weight required.

*When the weight is suspended from the middle.*

The value of  $c$  in Col. III. p. 50, multiplied by the tabular weight for the scantling in the Second Series, gives the breaking weight.

*Example 9.*—Required the breaking weight, suspended from the middle, of Riga Fir 12 feet long  $10 \times 6$ .

By Col. III. p. 50, for Riga Fir;  $c = 3.211$ .

By Table X. p. 70, the tabular weight for 12 feet long  $10 \times 6$  is 50 cwts.

$3.211 \times 50 = 160.55$  cwts.; the breaking weight required.

To find by the Table of Constants, No. 2, and the Second Series of Tables, the Scantlings of any Species of Timber sufficient to carry a weight, which shall be any given portion of the breaking weight.

*Weight uniformly loaded.*

The breaking weight in cwts. multiplied by the value of  $c$  in Col. II. p. 50, gives the tabular weight in the Second Series of Tables; and the scantling opposite thereto, or to the next greater weight, is one of the scantlings required.

*Example 10.*—Required the Scantlings of English Oak 12 feet long, sufficient to carry 80 cwts. uniformly loaded; the breaking weight to be 10 times that weight, or  $10 \times 80 = 800$  cwts. uniformly loaded.

By Col. II. p. 50, for English Oak;  $c = \cdot 1176$ .

$800 \times \cdot 1176 = 94\cdot 08$  cwts.; the tabular weight.

By the Second Series of Tables, the following are the scantlings and weights for 12 feet long:—

	Oak Scantlings.	Tabular Weights.	Notes.
Table IX. ...	9 × 14	94·50 cwts.	... ..
" X. ...	10 × 11½	95·83 "	$\frac{91\cdot 66 + 100\cdot 00}{2} = 95\cdot 83$
" " ...	10½ × 10½	96·46 "	$87\cdot 50 \times 1\cdot 1025 = 96\cdot 46$
" XI. ...	11 × 9½	95·79 "	$\frac{90\cdot 75 + 100\cdot 83}{2} = 95\cdot 79$
" XII. ...	12 × 8	96·00 "	... ..
" " ...	12½ × 7½	97·65 "	$90 \times 1\cdot 085 = 97\cdot 65$

To find the deflection of English Oak 12 feet long 12 × 8, uniformly loaded with  $\frac{1}{10}$ th of the breaking weight.

By Table II. p. 129, the deflection of Red Pine 12 inches deep and 12 feet long, uniformly loaded with  $\frac{1}{10}$ th of the breaking weight, is  $4 \times \cdot 394$

$$\frac{10}{10} = \cdot 1576.$$

By Col. VI. p. 50, for English Oak;  $c = 1\cdot 684$ .

$1\cdot 684 \times \cdot 1576 = \cdot 265$  of an inch; the deflection required.

*Example 11.*—Required the Joists and Beams for a Warehouse Floor, upon the following data:—

*Data for the Joists.*

Joists 8 feet long clear bearing, and 15 inches apart from middle to middle.

Greatest weight upon the floor, 3 cwt. per superficial foot.

Breaking weight of the joists, 6 times the weight upon the floor.

The weight upon each joist is  $\frac{3 \times 15 \times 8}{12} = 30$  cwt.

The breaking weight of each joist is  $6 \times 30 = 180$  cwt.

If the joists be Red Pine, then Col. II. p. 50;  $c = .125 = \frac{1}{8}$ ;

And  $\frac{180}{8} = 22.50$  cwt.; the tabular weight.

By the Second Series of Tables, the following are the scantlings and weights for 8 feet long:—

	Scantlings of the Joists.	Tabular Weights.	Notes.
Table VIII. . .	8 × 3	24.00 cwt.	
" "	8½ × 2½	25.78 "	20 × 1.289 = 25.78
" IX. . .	9 × 2¼	22.78 "	
" "	9½ × 2	22.56 "	20.25 × 1.114 = 22.56

*Data for the Beams.*

Beams 15 feet long and 9 feet apart from middle to middle.

Greatest weight upon each beam,  $9 \times 3 \times 15 = 405$  cwt.

Breaking weight of the beams, 4 times the weight upon the floor.

The breaking weight of each beam is  $4 \times 405 = 1620$  cwt.

If the timber be *sound* Memel, then Col. II. p. 50;  $c = .097$ ;

and  $1620 \times .097 = 157.14$  cwt.; the tabular weight.

By the Second Series of Tables, the following are the Scantlings and Weights for 15 feet long:—

	Scantlings of the Beams.	Tabular Weights.	Notes.
Table XIII. .	13 × 14 *	157.73 cwt.	
" "	13½ × 13½	164.02 "	152.10 × 1.0784 = 164.02
" XIV. .	14 × 12	156.80 "	
" "	14½ × 11½	161.18 "	150.26 × 1.7027 = 161.18
" XV. .	15 × 10½	157.50 "	$\frac{150 + 165}{2} = 157.50$



If the beams are mortised for the joists, add from  $\frac{1}{2}$  an inch to an inch to the depth or breadth of the beams.

\* \* In determining the Scantlings for RAKING BEAMS to carry a Gallery Floor, the horizontal distance between the breast-summer and the wall should be taken for the length of the beam, and the scantlings calculated as though the floor were level. The greatest weight upon a gallery floor, including the weight of the floor, ceiling, and framing, may be estimated at about 1·5 cwts. per superficial foot; and the breaking weight should be *not less* than 4 times the greatest weight.

*Weight suspended from the middle.*

The breaking weight in cwts, multiplied by the value of  $c$  in Col. IV. p. 50, gives the tabular weight.

*Example 12.*—Required the scantlings of English Oak 12 feet long, sufficient to carry 80 cwts. suspended from the middle; the breaking weight to be 5 times that weight.

By Col. IV. p. 50, for English Oak;  $c = \cdot 2353$ .

$$5 \times 80 \times \cdot 2353 = 94\cdot 12 \text{ cwts. ; the tabular weight.}$$

The scantlings are the same as in Example 10.

*Example 13.*—What should be the size of a beam 16 feet long clear bearing, to support a pair of scales suspended from the middle, for the purpose of weighing 2 tons of metal ?\*

Suppose the scales, weights, metal, and one-half the beam to weigh 86 cwts.

If the timber be Red Pine, and the deflection as in the First Series of Tables, then by Table XVII. p. 28, the Scantlings are,—

$$15\cdot 87 \times 8; 15\cdot 26 \times 9; 14\cdot 74 \times 10; 14\cdot 28 \times 11; 13\cdot 87 \times 12; \\ 13\cdot 50 \times 13; \&c.$$

Deflection of each scantling  $\frac{1\cdot 6}{3\cdot 3}$  of an inch.

If the beam be  $13\frac{1}{2} \times 13$ , then nearly 7 times the weight of the metal, &c., is the breaking weight of the beam.

\* The consideration of the above question, put to the Author May 24, 1847, led to the construction and eventually to the publication of these tables.

If the Scantlings be required which break with 4 times the suspended weight, the same are found by the Second Series of Tables.

For Red Pine, 86 cwts. is the tabular weight; and the following are the scantlings for 16 feet long; viz.:—

$10 \times 14$ ;  $11 \times 11\frac{1}{2}$ ;  $12 \times 10$ ;  $12\frac{1}{2} \times 9$ ;  $13 \times 8\frac{1}{2}$ ;  $13\frac{1}{2} \times 8$ ;  $14 \times 7\frac{1}{4}$ ;  
 $14\frac{1}{2} \times 6\frac{3}{4}$ ;  $15 \times 6\frac{1}{4}$ ;  $15\frac{1}{2} \times 5\frac{3}{4}$ ;  $16 \times 5\frac{1}{2}$ .

The deflections are given by the same tables.

*To find the Scantlings of any Species of Timber sufficient to carry a weight which shall be any given portion of the breaking weight, WHEN THE TIMBER PROJECTS WITH ONE END HORIZONTALLY FROM A WALL.*

*Weight uniformly loaded.*

The deflection of a joist or beam projecting with one end horizontally from a wall, with a given weight uniformly loaded, is 19.2 times the deflection of the same joist or beam supported at each end and uniformly loaded with the same weight; and the strength in the former position is to that in the latter as 1 is to 4.

For Red Pine, one-half of the breaking weight uniformly loaded, is the tabular weight in the Second Series of Tables.

*Example 14.*—Required the Scantlings of Red Pine, of any projection, sufficient to support 8 cwts. uniformly loaded; the scantlings to break with 10 times that weight.

$\frac{10 \times 8}{2} = 40$  cwts. is the tabular weight; in the Second Series of Tables, the Scantlings for 2 feet, 3 feet, and 4 feet projections, are as follow, viz.:—

Length or Projection, in feet.	Scantlings by the Second Series of Tables.
2	$3 \times 9$ ; $4 \times 5$ ; $5 \times 3\frac{1}{2}$ ; $6 \times 2\frac{1}{4}$ .
3	$4 \times 8$ ; $5 \times 5$ ; $6 \times 3\frac{1}{2}$ ; $7 \times 2\frac{1}{2}$ ; $8 \times 2$ .
4	$4 \times 10$ ; $5 \times 6\frac{1}{2}$ ; $5\frac{1}{2} \times 5\frac{1}{2}$ ; $6 \times 4\frac{1}{2}$ ; $7 \times 3\frac{1}{2}$ ; $8 \times 2\frac{1}{2}$ ; $9 \times 2$ .

By Table IV. p. 54, Red Pine  $4 \times 5$  and 2 feet long with 8 cwts. uniformly loaded, deflects  $\frac{8}{45} \times .016 = .0032$  of an inch; therefore, Red Pine  $4 \times 5$  and 2 feet projection with 8 cwts. uniformly loaded, deflects  $19.2 \times .0032 = .061$  of an inch.

*Weight suspended from the extremity.*

The deflection of a joist or beam, projecting with one end horizontally from a wall, with a given weight suspended from the extremity, is 32 times the deflection of the same joist or beam supported at each end, with the same weight suspended from the middle; and the strength in the former position is to that in the latter as 1 is to 4.

For Red Pine, the breaking weight suspended from the extremity, is the tabular weight in the Second Series of Tables.

*Example 15.*—Required the Scantlings of Red Pine, of any projection, sufficient to support 4 cwts. suspended from the extremity; the scantlings to break with 10 times that weight.

$10 \times 4 = 40$  cwts. is the tabular weight in the Second Series.

The scantlings for 2 feet, 3 feet and 4 feet projection are the same as in the last Example.

By Table IV. p. 54, Red Pine  $4 \times 5$  and 2 feet long with 4 cwts. suspended from the middle, deflects  $\frac{4}{45} \times .026 = .0026$  of an inch; therefore, Red Pine  $4 \times 5$  and 2 feet projection with 4 cwts. suspended from the extremity, deflects  $32 \times .0026 = .0832$  of an inch.

---

*To find the Scantlings of Red Pine sufficient to carry a weight, PLACED IN ANY POSITION UPON THE SCANTLING, which weight shall be any given portion of the breaking weight.*

*Weight uniformly loaded upon a portion of the Beam.*

When the weight is uniformly loaded upon a portion of a beam, find the weight uniformly loaded upon the whole of the beam which shall

have the same stress upon the middle of the beam as the given weight: the scantlings for the uniform load so found are those required.

*Example 16.\*—In Fig 1, let AB represent a beam 16 feet long; let C be the middle of the beam, and let 32 cwts. and 64 cwts. be placed upon AB, in the several positions shewn in the figure. Required the Scantlings which shall break with 8 times those weights in the several given positions.*

The uniform loads in *Fig. 2*, are found as below; and the scantlings to break with 8 times those or the given weights, are found by the Second Series of Tables.

Fig. 1.

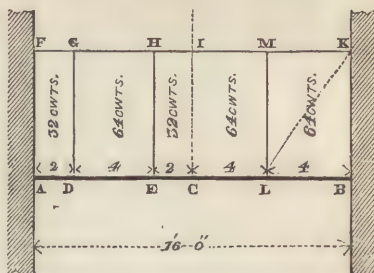
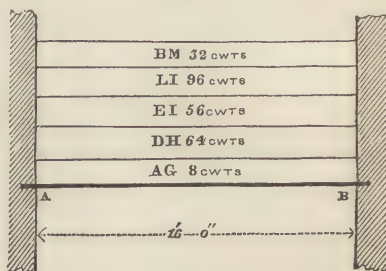


Fig. 2.



Weight (= W), upon the several parts of the beam AB in <i>Fig. 1</i> .	Weight in <i>Fig. 2</i> , uniformly loaded upon the beam AB, to have the same stress in the middle as the weight W in <i>Fig. 1</i> .	Scantling 16 inches deep.
Upon AD ... 32 cwts.	$\frac{AD}{AC} \times W = \frac{2}{8} \times 32 = 8$ cwts.	$16 \times \frac{1}{2}$
Upon DE ... 64 "	$\frac{AD + AE}{AC} \times W = \frac{3}{8} \times 64 = 24$ "	$16 \times 1\frac{1}{2}$
Upon EC ... 32 "	$\frac{AE + AC}{AC} \times W = \frac{1}{8} \times 32 = 4$ "	$16 \times 3\frac{1}{2}$
Upon LC ... 64 "	$\frac{BL + BC}{BC} \times W = \frac{1}{8} \times 64 = 8$ "	$16 \times 6$
Upon BL ... 64 "	$\frac{BL}{BC} \times W = \frac{1}{8} \times 64 = 8$ "	$16 \times 2$
Upon AB ... 256 cwts.	256 cwts.	$16 \times 16$

\* Examples 16 and 17 shew the method of finding the scantlings in other cases.



Scantlings of nearly equal strength, sufficient to carry the weights in *Figs. 2* or *1*, the breaking weight being 8 times the respective weights.

Weight uniformly loaded in <i>Fig. 2</i> .	Scantlings by the Second Series of Tables. Length 16 feet clear bearing.
AG = 8 cwts.	$4 \times 8$ ; $5 \times 5\frac{1}{4}$ ; $6 \times 3\frac{3}{4}$ ; $7 \times 2\frac{3}{4}$ ; $8 \times 2$ .
DH = 64 "	$\left\{ \begin{array}{l} 9 \times 13; 10 \times 10\frac{1}{2}; 11 \times 8\frac{1}{2}; 12 \times 7\frac{1}{4}; 13 \times 6\frac{1}{4}; 14 \times 5\frac{1}{4}; \\ 15 \times 4\frac{3}{4}; 16 \times 4. \end{array} \right.$
EI = 56 "	$\left\{ \begin{array}{l} 8 \times 14; 9 \times 11\frac{1}{4}; 10 \times 9; 11 \times 7\frac{1}{2}; 12 \times 6\frac{1}{4}; 13 \times 5\frac{1}{2}; \\ 14 \times 4\frac{3}{4}; 15 \times 4; 16 \times 3\frac{1}{2}. \end{array} \right.$
LI = 96 "	$11 \times 13$ ; $12 \times 10\frac{3}{4}$ ; $13 \times 9\frac{1}{4}$ ; $14 \times 7\frac{3}{4}$ ; $15 \times 7$ ; $16 \times 6$ .
BM = 32 "	$\left\{ \begin{array}{l} 6 \times 14\frac{1}{4}; 7 \times 11; 8 \times 8; 9 \times 6\frac{1}{2}; 10 \times 5\frac{1}{4}; 11 \times 4\frac{1}{4}; \\ 12 \times 3\frac{3}{4}; 13 \times 3\frac{1}{4}; 14 \times 2\frac{3}{4}; 15 \times 2\frac{1}{2}; 16 \times 2. \end{array} \right.$

*Notes to the preceding Example, No. 16.*

1. If the weight DH be placed in the middle between A and C, then  $AD + AE = AC$ ; and the stress at C from the weight DH in *Fig. 1*, = stress at C from the weight DH uniformly loaded; as in the Example.

2. If the middle of the beam or the point C be between E and L, the weight uniformly loaded to have the same stress at C as the weight EM may be found thus:—

Let the weight  $EM = W' = 96$  cwts., then the weight uniformly loaded to have the same stress at C as the weight EM, is

$$W' + \frac{AE \times EC + BL \times LC}{AC \times EL} \times W' = 96 + \frac{12 + 16}{48} \times 96 = 152 \text{ cwts.};$$

and the Scantling for that weight by Table XVI., is  $16 \times 9\frac{1}{2}$ ; or  $15 \times 11$ ;  $14\frac{1}{2} \times 11\frac{1}{2}$ ;  $14 \times 12\frac{1}{2}$ ;  $13\frac{1}{2} \times 13\frac{1}{2}$ ; &c.

3. If  $CE = CL$  or  $AE = BL$ , then the required weight uniformly loaded is

$$W' + \frac{AE}{AC} \times W' = 96 + \frac{5}{8} \times 96 = 156 \text{ cwts.}$$

4. In *Fig. 1*, join LK; let the weight of the triangular prism of which the section is  $LBK = W' = 32$  cwts.; then the weight uniformly loaded to have the same stress at C as LBK is,

$$\frac{2}{3} \times \frac{BL}{BC} \times W' = \frac{2}{3} \times \frac{4}{8} \times 32 = 10\frac{2}{3} = 10.66 \text{ cwts.};$$

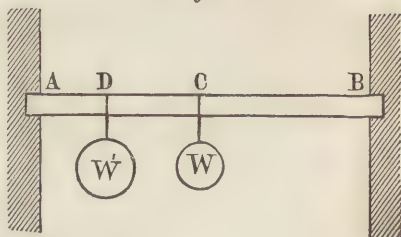
and the length being 16 feet, the scantlings for 10.66 cwts. or the next greater weight are,

$$4 \times 10\frac{1}{2}; 5 \times 7; 6 \times 4\frac{3}{4}; 6\frac{1}{2} \times 4\frac{1}{4}; 7 \times 3\frac{1}{2}; 7\frac{1}{2} \times 3\frac{1}{4}; 8 \times 2\frac{3}{4}; 8\frac{1}{2} \times 2\frac{1}{2}; 9 \times 2\frac{1}{4}; \\ 9\frac{1}{2} \times 2.$$

5. The stress at C from the weight LBK, is  $\frac{1}{3}$  of the stress at C from the weight BM.

*Weight suspended from a given point.*

When the weight  $W'$  is suspended from any given point  $D$  in the beam  $AB$ , as in *Fig. 3*, then the weight  $W$  suspended from  $C$ , the middle of the beam  $AB$ , to have the same stress at  $C$  as the weight  $W'$  at  $D$ , is

*Fig. 3*

$$W = \frac{AD \times DB}{AC^2} \times W' \dots\dots\dots (A);$$

and the scantlings are very readily found by the Second Series of Tables.

*Example 17.*—Required the Scantlings of Red Pine 16 feet long to support 128 cwts. suspended 4 feet from the wall; the breaking weight of the scantlings to be 4 times that weight.

$AB = 16$ ;  $AC = 8$ ;  $AD = 4$ ;  $DB = 12$ ;  $W' = 128$  cwts.;

From (A) we have

$W = \frac{AD \times DB}{AC^2} \times W' = \frac{4 \times 12}{8 \times 8} \times 128 = 96$  cwts. suspended from the middle, which being one-fourth of the breaking weight, by the Second Series of Tables, the Scantlings for 16 feet long are,—

$11 \times 12\frac{3}{4}$ ;  $12 \times 10\frac{2}{3}$ ;  $12\frac{1}{2} \times 10$ ;  $13 \times 9\frac{1}{4}$ ;  $13\frac{1}{2} \times 8\frac{1}{2}$ ;  $14 \times 8$ ;  
 $14\frac{1}{2} \times 7\frac{1}{2}$ ;  $15 \times 7$ ;  $15\frac{1}{2} \times 6\frac{1}{2}$ ;  $16 \times 6$ .

Multiplying the breadths by  $\frac{4.5}{4}$ ;  $\frac{5}{4}$ ;  $\frac{5.5}{4}$ ;  $\frac{6}{4}$ ; &c.; the scantlings are found which break with  $4\frac{1}{2}$  times, 5 times,  $5\frac{1}{2}$  times, 6 times, &c. the tabular or given weight.

*Note.*—The breadth of Trimmer Joists, to have the same strength as the joists in the same floor, may be found as follows:—

Let  $W'$  = the weight at  $D$ , from one end of a trimmer fixed to  $AB$  at  $D$ ;

$W$  = stress at  $C$ , found as above, from the weight  $W'$ ;

$W''$  = one half of the weight uniformly loaded upon a floor joist;

$b$  = breadth of a joist;

then, the length and depth being the same, for a trimmer joist  $AB$  to have the same Strength as the joists in the same floor, the breadth of  $AB$  should be,—

$$\frac{W + W''}{W''} \times b \dots\dots\dots (B).$$

OF THE PRESSURE UPON BREST-SUMMERS, PLATES, AND PURLINS, SUSTAINING LOADED BEAMS AND RAFTERS, INCLINED AT GIVEN ANGLES TO THE HORIZONTAL PLANE.

In *Fig. 4*, in the annexed plate, let the beam *AC*, fixed in position, be inclined to the horizontal and vertical planes, *AB*, *BC* at the angles *CAB*, *ACB*; through *G* the centre of gravity of *AC* draw the vertical line *FGH*; through *C* draw any line *ICE* cutting *FH* in *E*; join *EA* and produce *EA* to *K*; then *AC* will be retained in its position by the ropes *EC*, *EA*; or by the props *CI*, *AK*; or by the rope *EC* and prop *AK*; or by the rope *EA* and prop *CI*; or by the brest-summers, plates or purlins *P* and *Q*; the plane surfaces of which, viz. *Ce*, *Ad*, are at right angles to *EC*, *EA* respectively.

Let the weight of the beam *AC* and the load thereon = *W*.

Let *Ec* = 1·00 represent *W*; draw *ca*, *cb*, parallel to *EI*, *EK*, cutting *EK*, *EI* in *a* and *b*; then

Pressure upon *P* in the direction *EC* =  $Eb \times W$  ..... (1);

Pressure upon *Q* in the direction *EA* =  $Ea \times W$  ..... (2).

The beam *AC*, the centre of gravity *G*, and the vertical line *FH* through *G*, being fixed in position, let *ICE*, cutting *FH* in *E*, and the plate or purlin *P*, revolve round *C* as a centre, then *E'AK'* being drawn, the relative positions of *P* and *Q* are given which retain *AC* in equilibrium; *E'c'* = 1·00 represents, as before, the weight *AC*, and *E'b'*, *E'a'*, the relative pressures upon *P* and *Q* respectively.

When *ICE* coincides with *BC*, then *KE* is parallel to *IE*, and the surfaces *Ce*, *Ad*, perpendicular thereto, are horizontal, as in *Figs. 7* and *8*; in which case there is evidently no horizontal thrust.

In *Fig. 7*, let *W* = weight of *AC*; then

Vertical pressure  $p'$  upon *P* =  $\frac{AD}{AB} \times W$  ..... (3);

Vertical pressure  $p$  upon *Q* =  $\frac{DB}{AB} \times W$  ..... (4).

If *AD* = *DB*, or the centre of gravity *G* be in the middle of *AC*, the vertical pressures upon *P* and *Q* =  $\frac{1}{2}$  weight of *AC*; and

In *Fig. 8*, the vertical pressure upon *Q* = weight of *GG*.

*Fig. 10*.—When *ICE*, *Fig. 4*, is at right angles to *AC*, the relative positions of *P* and *Q* are as in *Fig. 10*.

If the centre of gravity  $G$  be in the middle between  $P$  and  $Q$ , and if  $W$  = weight of the rafter between  $P$  and  $Q$ ; then if  $Ec = 1.00$ , we have

Pressure upon  $P$  in the direction  $Eb = Eb \times W$  ..... (5);

Pressure upon  $Q$  in the direction  $Ea = Ea \times W$  ..... (6);

or twice those pressures, if the rafters are continued to the purlin  $P'$ , and to a purlin  $Q'$ , at the same distance apart, from  $P$  towards  $C$ .

In *Figs. 8 and 10*, the pressures upon  $P$  and  $Q$ , ARISING FROM THE WEIGHT OF THE ROOF ALONE, are in the direction of the depth only; therefore the scantlings may be found by the First or Second Series of Tables. Scantlings fixed by the rule derived from *Fig. 4*, so as to have one pressure only, and that in the direction of the depth, should be firmly secured at each end in the required position, with only the one bearing surface in contact with  $AC$  as shewn in the figures; otherwise, the pressures being changed, the equilibrium of the whole will be thereby destroyed.

When  $ICE$  is parallel to  $BA$ , the position of  $P$  is the same as in *Fig 5*; but the position of  $Q$  not being at right angles to  $EA$ ,  $Q$  in *Fig. 5* is subjected to two pressures  $p$  and  $q$ , as shewn in the figure; and the scantlings for  $Q$  to sustain such pressures, may be found by the Table page xxxviii., or by the Third Series of Tables.

To measure the relative pressures, it will be convenient to set off  $Ec = 1$  inch, the inch being divided into tenths, or set off  $Ec = 10$  feet from any scale; then the various lines in any of the parallelograms  $Eacb$ , measured by the same scale, give the relative pressures upon  $P$  and  $Q$ ; which relative pressures being multiplied by the weight of  $AC$ , the actual pressures upon  $P$  and  $Q$  are given in the several directions.

In *Fig. 5*,  $Ec = 1.00$ , represents the vertical pressure  $p$  upon  $Q$ ; and  $ca = Eb$ , the pressures  $q$  and  $q'$ .

In *Fig. 6*,  $Ec$  being 1.00,  $Ed$  is the measure of the vertical pressure  $p$ ;

$Ee$  is the measure of the vertical pressure  $p'$ ;

and  $da = eb$  is the measure of the pressures  $q$  and  $q'$ .

Since  $p + p' = Ed + Ee = Ec$ ; the sum of the vertical pressures upon  $P$  and  $Q$ , is always equal to the weight of  $AC$ .

In *Fig. 9*, the purlins  $P$  and  $Q$  are fixed at right angles to the back of the rafter, and are supposed to sustain the whole pressure of the roof, in the directions  $Eb$  and  $CA$ .

If  $Ec$  represent the weight of the rafter between  $P$  and  $Q$ , then



$Eb$ , and  $bd = da$  are the pressures to be sustained by each of the purlins P and Q; the pressures being twice those, if the rafters are continued as in the description to *Fig. 10*.

When  $BC = AB$ , as in the figure, then  $bd = Eb$ ; the purlins are square, and the scantlings are found by Table VI. in the Third Series; or by Col. X. page xxxviii.

When  $BC = \frac{1}{2} AB$ , then  $bd = \frac{1}{2} Eb$ ; the sides of the purlins are to one another as 1 to  $\sqrt{5}$ , or as 10 to 7.07, and the scantlings are found by Table IV. Third Series, or by Col. VII., page xxxviii.

In *Fig. 11*, the purlin P is at right angles to the back of the rafter, as in *Fig. 9*.  $cb$  represents the weight of the roof acting vertically, and  $ac$  the force of the wind acting at right angles to AC; completing the parallelogram  $Eacb$ ,  $Ec$  is the position of a purlin to resist the two pressures  $bc$ ,  $ac$ , acting together, so as to have only one thrust, and that to be in the direction of the depth of the purlin; P being the position to resist with greatest effect the pressure from the wind alone, and Q the position to resist the weight of the roof alone.

When the two forces act together,  $Ed$  is the pressure upon P in the direction  $ac$ , and  $dc$  is the pressure upon P in the direction  $dc$ . In like manner  $Fc' = a'd' + b'c'$  is the pressure upon Q in the direction  $Fc'$ ;  $d'c'$  the pressure upon Q in the direction  $d'c'$ ; and by dividing the least pressure by the greatest, the scantlings may be found by the Third Series of Tables, or by the Table before referred to at page xxxviii.

### THE THIRD SERIES OF TABLES;

By which may be found the Scantlings of any description of Timber, to have given equal deflections when acted upon by two forces; viz., one in the direction of the depth, the other in the direction of the breadth.

The pressures upon a brest-summer or purlin being ascertained or given, and the deflection with those pressures assumed, the scantlings are found by the Third Series of Tables.

If the assumed deflection be the tabular deflection, the scantlings are given by inspection of the tables.

If the assumed deflection be less than the tabular deflection, the scantlings are found by means of the expression  $\frac{P}{D}$  at the foot of each table.

In other cases it will be more convenient to find the scantlings by the table page xxxviii.

The DEPTH is the greatest side; the BREADTH, the least side of the scantling.

P is the pressure in lbs. or cwts. in the direction of the depth.

D, the deflection in inches or parts of an inch.

$p$  and  $q$  denote the relative pressures as described in the Explanation to the diagrams.

The least divided by the greatest pressure determines the table by which the scantlings are found, thus:—

If  $\frac{p}{q}$  or  $\frac{q}{p} = \cdot 16$ , the Scantlings are found by Table I.;

If  $\frac{p}{p}$  or  $\frac{q}{q} = \cdot 25$ , the Scantlings are found by Table II.;

and so on.

In the following Examples, the scantlings are those of Red Pine. The scantlings of other kinds of timber are found by the Table of Constants, No. 3, p. 96.

### EXAMPLES TO THE THIRD SERIES OF TABLES.

*Example 18.*—Required the Scantling for any given length of the Brest-summer Q, *Fig. 5*, upon the following data, viz.:

Centre of gravity G in the middle of AC;  $BC = \frac{1}{2} AB$ ;

Weight of AC for one foot in length of Q = 12·25 cwts.;

Pressure uniform; the deflection to be as given by the table.

The diagonal Ec, and the sides ca, Eb, of the parallelogram Eacb, are equal.

$Ec = ca = p = q$ . The scantlings are given by Table VI.

The pressure upon each foot in length being 12·25 cwts.; the scantlings are given by Col. XII. p. 120.

If the length be 9 feet, the scantling is  $10\cdot 07 \times 10\cdot 07$ .

If the length be 10 feet, the scantling is  $10\cdot 89 \times 10\cdot 89$ .

Deflections each way,  $\frac{1}{75}$  of an inch to the foot.

Breaking weight, upwards of 8 times the pressure upon the brest-summer.

*Example 19.*—The data in other respects being the same as in the last Example,—Required the Scantling of the Brest-summer Q, 12 feet long, to support the same pressures, and deflect each way  $\frac{1}{10}$  of an inch.

$$P = 12 \times 12 \cdot 25 = 147 \text{ cwts.}; \quad D = \frac{1}{10}.$$

$$\frac{P}{D} = \frac{147}{\frac{1}{10}} = 147 \times 10 = 1470 \text{ cwts. uniform pressure.}$$

$$\text{By Col. XIV. p. 120, } \frac{P}{D} = 1462 \cdot 85 \text{ cwts. Scantling, } 14 \cdot 28 \times 14 \cdot 28.$$

If the same pressure be in the middle of Q,—

$$\text{By Col. XVI. } \frac{P}{D} = 1464 \cdot 50 \text{ cwts. Scantling, } 16 \cdot 06 \times 16 \cdot 06.$$

*Example 20.*—Required the Scantlings, for any given length, of the Brest-summer Q, *Fig. 6*.

Having drawn the figure, let the relative pressures measure as follow, viz. :—

$$Ec = 1 \cdot 00; \quad Ed = \cdot 60; \quad dc = \cdot 40; \quad da = eb = \cdot 22.$$

$$\text{Pressure } p = Ed = \cdot 60; \quad \text{pressure } q = da = \cdot 22.$$

$$\frac{\text{Least pressure}}{\text{Greatest pressure}} = \frac{q}{p} = \frac{\cdot 22}{\cdot 60} = \cdot 36; \text{ the scantlings are given by Table III.}$$

If the pressure upon Q be uniform, and the weight of AC be 9.9 cwts. to the foot, the greatest pressure ( $p$ ) upon

$$Q = \cdot 60 \times 9 \cdot 9 = 5 \cdot 94 \text{ cwts. to the foot.}$$

The scantlings are given by Col. IX. p. 107.

$$\text{If the length be 10 feet, the scantling is } 9 \cdot 73 \times 5 \cdot 84.$$

$$\text{If the length be 11 feet, the scantling is } 10 \cdot 45 \times 6 \cdot 27.$$

$$\text{Deflection each way, } \frac{1}{55} \text{ of an inch to the foot.}$$

$$\text{Breaking weight, upwards of 7 times the pressures upon Q.}$$

*Example 21. Fig. 6.*—Let the weight of AC, resting upon the middle of Q, be 80 cwts. Length of Q, 12 feet; Deflection of Q each way,  $\frac{1}{8}$  of an inch. Pressures as in the last Example.

The greatest pressure ( $p$ ) upon Q, is  $Ed \times 80 = \cdot 60 \times 80 = 48 \text{ cwts.}$

$$P = 48 \text{ cwts.} \quad D = \frac{1}{8}.$$

$$\frac{P}{D} = \frac{48}{\frac{1}{8}} = 384 \text{ cwts. pressure in the middle.}$$

$$\text{By Col. XI. p. 108, } \frac{P}{D} = 398 \cdot 45 \text{ cwts. Scantling, } 13 \cdot 18 \times 7 \cdot 91.$$

## A TABLE

By which may be found the Scantlings of Red Pine BREST-SUMMERS and PURLINS sufficient to carry, in the direction of the depth or greatest side, any given portion of the breaking weight.

Greatest side, or Depth in inches.	PRESSURE IN THE DIRECTION OF THE BREADTH.									Pressure uniform.	Pressure in the middle.	
	·04	·09	·16	·25	·36	·49	·64	·81	1·00	Product of the Length in Feet; by the Breaking weight in cwt.; by the Factor for the pressure.		
	LEAST SIDE, OR BREADTH IN INCHES.											
4	·80	1·20	1·60	2·00	2·40	2·80	3·20	3·60	4·00	512	256	
4½	·90	1·35	1·80	2·25	2·70	3·15	3·60	4·05	4·50	729	364	
5	1·00	1·50	2·00	2·50	3·00	3·50	4·00	4·50	5·00	1000	500	
5½	1·10	1·65	2·20	2·75	3·30	3·85	4·40	4·95	5·50	1331	665	
6	1·20	1·80	2·40	3·00	3·60	4·20	4·80	5·40	6·00	1728	864	
6½	1·30	1·95	2·60	3·25	3·90	4·55	5·20	5·85	6·50	2197	1098	
7	1·40	2·10	2·80	3·50	4·20	4·90	5·60	6·30	7·00	2744	1372	
7½	1·50	2·25	3·00	3·75	4·50	5·25	6·00	6·75	7·50	3375	1687	
8	1·60	2·40	3·20	4·00	4·80	5·60	6·40	7·20	8·00	4096	2048	
8½	1·70	2·55	3·40	4·25	5·10	5·95	6·80	7·65	8·50	4913	2456	
9	1·80	2·70	3·60	4·50	5·40	6·30	7·20	8·10	9·00	5832	2916	
9½	1·90	2·85	3·80	4·75	5·70	6·65	7·60	8·55	9·50	6859	3429	
10	2·00	3·00	4·00	5·00	6·00	7·00	8·00	9·00	10·00	8000	4000	
10½	2·10	3·15	4·20	5·25	6·30	7·35	8·40	9·45	10·50	9261	4630	
11	2·20	3·30	4·40	5·50	6·60	7·70	8·80	9·90	11·00	10648	5324	
11½	2·30	3·45	4·60	5·75	6·90	8·05	9·20	10·35	11·50	12167	6083	
12	2·40	3·60	4·80	6·00	7·20	8·40	9·60	10·80	12·00	13824	6912	
12½	2·50	3·75	5·00	6·25	7·50	8·75	10·00	11·25	12·50	15625	7812	
13	2·60	3·90	5·20	6·50	7·80	9·10	10·40	11·70	13·00	17576	8788	
13½	2·70	4·05	5·40	6·75	8·10	9·45	10·80	12·15	13·50	19683	9841	
14	2·80	4·20	5·60	7·00	8·40	9·80	11·20	12·60	14·00	21952	10976	
14½	2·90	4·35	5·80	7·25	8·70	10·15	11·60	13·05	14·50	24389	12194	
15	3·00	4·50	6·00	7·50	9·00	10·50	12·00	13·50	15·00	27000	13500	
15½	3·10	4·65	6·20	7·75	9·30	10·85	12·40	13·95	15·50	29791	14895	
16	3·20	4·80	6·40	8·00	9·60	11·20	12·80	14·40	16·00	32768	16384	
Factors for the Pressure in the direction of the Breadth.											Note.—The pressure in the direction of the Depth is 1.	
	5.	$\frac{10}{3}$ .	$\frac{5}{2}$ .	2.	$\frac{5}{3}$ .	$\frac{10}{7}$ .	$\frac{5}{4}$ .	$\frac{10}{9}$ .	1.			
I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	



## EXAMPLES TO THE ANNEXED TABLE.

The DEPTH, is the greatest side ; the BREADTH, the least side ; without reference to the position of the scantling.

In the direction of the depth, the least pressure divided by the greatest, gives the pressure in the direction of the breadth.

Multiply together

The length in feet ;

The breaking weight in cwt. ; and

The factor for the pressure.

If the pressure be uniform, the Scantling is found by Column XI.

If the pressure be in the middle, the Scantling is found by Col. XII.

*Example 22.*—Required the Scantling of a Brest-summer to support a Shed Roof, fixed as in *Fig. 5*, (*plate*, p. xxxiii) upon the following *Data*.

Length of the Brest-summer Q, clear of the supports, 20 feet.

Weight of the Roof AC,  $20 \times 2.5 = 50$  cwt.

Pressure upon Q, uniform.

Breaking weight of Q, 8 times the pressure upon Q.

Centre of gravity G, in the middle of AC ;  $BC = \frac{1}{2} AB$ .

Since  $BC = \frac{1}{2} AB$  ;  $Ec (= 1.00)$ ,  $= ca$ ,  $=$  pressure  $p$ ,  $=$  pressure  $q$  ; therefore

The pressures  $p$  and  $q$  are each equal to the weight of the roof ;

$$\frac{p}{q} = 1.00 ; = \text{pressure for the breadth (Col. X.)}$$

Length 20 feet ; Breaking weight  $50 \times 8 = 400$  cwt. ; Factor 1.

$20 \times 400 \times 1 = 8000$ , the tabular number. Pressure uniform.

Scantling, Cols. X. and I.,  $10 \times 10$ . (See also page 71.)

By Table II. (p. 130), a Red Pine brest-summer 10 inches deep and 20 feet long, uniformly loaded with *one-eighth* of the breaking weight, deflects each way  $\frac{4 \times 1.315}{8} = .657$  of an inch.

If the deflections be too great, the scantling for any other deflection may be found by Table VI. in the Third Series of Tables, thus :—

Let the deflection each way of the brest-summer be  $\frac{1}{4}$  of an inch ;

$$P = 20 \times 2.5 = 50 \text{ cwt. ; } D = \frac{1}{4}.$$

$$\frac{P}{D} = \frac{50}{\frac{1}{4}} = 50 \times 4 = 200 \text{ cwt. Pressure uniform.}$$

By Col. VIII. (p. 119),  $\frac{P}{D} = 223.21$  cwt. Scantling  $13.09 \times 13.09$ .

*Example 23.—Fig. 5.*—Required the Scantling of the Brest-summer Q, 20 feet long, upon the following

*Data.*

Weight of the raking beam AC, resting upon the middle of Q, 50 cwt.;  
Breaking weight of Q, 10 times the pressure upon Q.

Let  $BC = \frac{1}{2} AB$ , then (*Ex. 22*) pressure  $p = q =$  weight of AC.

Length 20 feet; Breaking weight of Q,  $10 \times 50 = 500$  cwt.;

Factor for the pressure, 1.00.

$20 \times 500 \times 1.00 = 10000$ , pressure in the middle.

Col. XII. p. xxxviii., opposite 10976, the Scantling is  $14 \times 14$ .

Deflection each way (p. 130),  $\frac{4 \times .939}{10} \times .8 = \frac{3}{10}$  of an inch.

*Example 24.—Fig. 5.*—Let  $BC = AB$ . Data in other respects as in Example 22. Required the Scantling of Q.

Since  $BC = AB$ , we have  $ca = \frac{1}{2} Ec$ ; or  $p = 1.00$ ,  $q = .50$ .

$\frac{\text{Least pressure}}{\text{Greatest pressure}} = \frac{q}{p} = \frac{.50}{1.00} = .50$ ; the breadth is found by Col. VII.

Length 20 feet; Breaking weight  $50 \times 8 = 400$  cwt.; Factor  $\frac{10}{7}$ .

$20 \times 400 \times \frac{10}{7} = 11428$ , the tabular number. Pressure uniform.

Opposite 12167, Col. XI., the scantling is  $11\frac{1}{2} \times 8.05$ .

Deflection each way, (p. 130),  $\frac{4 \times 1.143}{8} = .571$  of an inch.

If the pressure 50 cwt. be in the middle of Q,—

Opposite 12194, Col. XII., the scantling is  $14\frac{1}{2} \times 10.15$ .

Deflection each way (p. 130),  $\frac{4 \times .907}{8} \times .8 = .362$  of an inch.

\* \* \* By the Table p. xxxviii., may be found the scantlings of beams, &c., pressed by one force only, such as beams for warehouse floors, &c., the sides of which shall be in any usual proportion, and sufficient to carry any given portion of the breaking weight. If the beams be square, the scantlings are found by Col. X. If in the proportion of 10 to 8, by Col. VIII.; and so on.

Joists continued over beams, beams and brest-summer over columns, rafters over purlins, purlins over principals, &c., in all such cases where the ends are continued and fixed, the strength of the intermediate lengths is increased one half. In reducing the scantlings accordingly, it will be requisite to bear in mind the maxim, that, THE STRENGTH OF A FLOOR OR ANY SYSTEM OF FRAMING, DOES NOT EXCEED THAT OF THE WEAKEST PART.

NOTE, on the Table No. 3 in Tredgold's Elementary Principles of Carpentry.

Let the Scantlings for Single Joisting, &c., in the Table No. 3 in Tredgold's Carpentry be those of Red Pine, of the standard strength and elasticity assumed throughout these tables, then every scantling therein, uniformly loaded with a weight of 1814 lbs. = 16.197 cwt., deflects in the middle  $\frac{1}{40}$  of an inch to the foot. If, therefore, 1814 be divided by the length in feet, the scantlings there given, within the limits of 20 feet long and 3 inches in breadth, may be found, nearly, by the Miscellaneous Tables, Nos. 3 to 9, in this work.

TABLES.

## TABLE OF CONSTANTS. No. 1.

By which may be found the Scantlings of the following species of Timber, to have the same STRENGTH or DEFLECTION as those of Red Pine.\*

NAME OF THE WOOD.	STRENGTH.			ELASTICITY.		
	Relative Strength.	Depth to have the same strength.	Breadth to have the same strength.	Relative Elasticity.	Depth to have the same deflection.	Weight to have the same deflection.
	$c=S.$	$c=\frac{1}{\sqrt{S}}.$	$c=\frac{1}{S}.$	$c=E.$	$c=\sqrt{E}.$	$c=\frac{1}{E}.$
Standard, } Strength ... 1344 Red Pine } Elasticity 230000	1·0000	1·000	1·000	1·0000	1·000	1·000
Acacia .....	1·3891	·848	·720	1·5972	1·169	·626
Ash .....	1·5084	·814	·663	1·1185	1·038	·894
Beech .....	1·1588	·929	·863	1·3594	1·108	·735
Birch, American black ...	1·3526	·860	·739	1·2459	1·076	·802
„ Common .....	1·4345	·835	·697	1·1186	1·038	·894
Bullet tree .....	1·9717	1·404	·507	·6999	·888	1·428
Cabacally .....	1·8735	·731	·534	·9961	·999	1·004
Deal, Christiana .....	1·1577	·929	·864	1·1575	1·050	·864
„ Memel .....	1·2879	·881	·776	1·1197	1·038	·893
Elm .....	·7552	1·151	1·324	2·6781	1·389	·373
Fir, Mar Forest .....	·9044	·1051	1·106	2·1865	1·298	·457
„ New England .....	·8203	1·104	1·219	1·2327	1·072	·811
„ Riga .....	·8029	1·116	1·245	1·6033	1·170	·623
Green-heart .....	2·0364	·701	·491	·6928	·885	1·443
Larch .....	·7444	1·159	1·343	2·0096	1·262	·497
Locust tree .....	2·5572	·625	·391	·9457	·982	1·057
Norway spars .....	1·0959	·955	·912	1·2620	1·081	·792
Oak, Adriatic .....	1·0286	·986	·972	1·8940	1·237	·528
„ African, superior quality	1·8571	·734	·538	·7983	·928	1·252
„ Canadian .....	1·3144	·872	·761	·9507	·983	1·051
„ Dantzic .....	1·0937	·956	·914	1·5778	1·164	·633
„ English .....	1·0621	·970	·942	1·5857	1·166	·630
Pine, Pitch .....	1·2141	·908	·824	1·5024	1·145	·665
„ Red, mean strength 1341·3	·9980	1·001	1·002	1·0000	1·000	1·000
Poon .....	1·6523	·778	·605	1·0892	1·029	·918
Teak .....	1·8326	·739	·546	·7623	·913	1·311
Tonquin bean .....	2·6979	·609	·371	·6928	·885	1·443
Minimum Strength .....	·9000	1·054	1·111	...	...	...
Mean Strength .....	1·0000	1·000	1·000	...	...	...
Maximum Strength .....	1·0800	·962	·926	...	...	...
	Col. I.	II.	III.	IV.	V.	VI.

\* See Examples, page xxii.

The values of S and E are founded upon the mean values of S and E, Tables X. and XI. p. 146—148.



## FIRST SERIES OF TABLES :

BY WHICH AND THE TABLE OF CONSTANTS MAY BE FOUND THE SCANTLINGS  
OF ANY SPECIES OF TIMBER SUFFICIENT TO CARRY A GIVEN  
WEIGHT,  
AND TO HAVE WITH THAT WEIGHT A GIVEN DEFLECTION.

\* \* \* To find the Scantlings of Red Pine and other kinds of Timber  
by the First Series of Tables, see Examples, p. xvii—xxiii.

TABLE I.—RED PINE.

WEIGHT upon each foot in length, 1 lb.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded, .....  $\frac{W}{D} = 40$ Weight suspended from the middle,  $\frac{W}{D} = 25$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in lbs.	Weight suspended from the middle, in lbs.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·16	·15	·14	·14	·13	·13	·12	1·00	·62	1 40
2	·32	·30	·29	·28	·27	·25	·24	2·00	1·25	2 40
*3	·47	·45	·43	·41	·40	·38	·36	3·00	1·87	3 40
4	·63	·60	·57	·55	·53	·50	·48	4·00	2·50	4 40
5	·79	·75	·72	·69	·66	·63	·59	5·00	3·12	5 40
6	·95	·90	·86	·83	·80	·75	·71	6·00	3·75	6 40
7	1·10	1·05	1·00	·96	·93	·88	·83	7·00	4·37	7 40
8	1·26	1·20	1·15	1·10	1·06	1·00	·95	8·00	5·00	8 40
9	1·42	1·35	1·29	1·24	1·20	1·13	1·07	9·00	5·62	9 40
10	1·58	1·50	1·43	1·38	1·33	1·25	1·19	10·00	6·25	10 40
11	1·73	1·65	1·57	1·51	1·46	1·38	1·31	11·00	6·87	11 40
12	1·89	1·80	1·72	1·65	1·59	1·50	1·43	12·00	7·50	12 40
13	2·05	1·95	1·86	1·79	1·73	1·63	1·54	13·00	8·12	13 40
14	2·21	2·10	2·00	1·93	1·86	1·75	1·66	14·00	8·75	14 40
15	2·36	2·25	2·15	2·07	1·99	1·88	1·78	15·00	9·37	15 40

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

33·37	35·12	36·73	38·21	39·56	42·04	44·25	Uniformly loaded.
26·69	28·10	29·38	30·57	31·65	33·63	35·40	Suspended from the middle.

\* Example.—Red Pine 3 feet long, ·47 in. by  $1\frac{1}{2}$  in., or ·45 by  $1\frac{3}{4}$ , or ·43 by 2, or ·41 by  $2\frac{1}{4}$ , or ·40 by  $2\frac{1}{2}$ , or ·38 by 3, or ·36 by  $3\frac{1}{2}$ , with 3 lbs. uniformly loaded, or 1·87 lbs. suspended from the middle, deflects  $\frac{3}{40}$  of an inch.

The breaking weight of Red Pine 3 ft. long, ·47 in. by  $1\frac{1}{2}$  in., is  $33·37 \times 3 = 100$  lbs. uniformly loaded, or  $26·69 \times 1·87 = 50$  lbs. suspended from the middle. The breaking weight of Red Pine 4 ft. long, ·63 in. by  $1\frac{1}{2}$  in., is  $33·37 \times 4 = 133$  lbs. uniformly loaded, or  $26·69 \times 2·50 = 66$  lbs. suspended from the middle; and so on throughout the table; the breaking weight suspended from the middle being, in all cases, one half of the weight uniformly loaded.

\* \* To find the depths of other kinds of timber to have the same deflection or strength as Red Pine, also for the use of the expression  $\frac{W}{D}$ , see the Table of Constants and Examples.

TABLE II.—RED PINE.

WEIGHT upon each foot in length, 8 lbs.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 320$  lbs.

Weight suspended from the middle,  $\frac{W}{D} = 200$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in lbs.	Weight suspended from the middle, in lbs.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·32	·30	·29	·28	·27	·25	·24	8·00	5·00	$\frac{1}{40}$
2	·63	·60	·57	·55	·53	·50	·48	16·00	10·00	$\frac{2}{40}$
3	·95	·90	·86	·83	·80	·75	·71	24·00	15·00	$\frac{3}{40}$
*4	1·26	1·20	1·15	1·10	1·06	1·00	·95	32·00	20·00	$\frac{4}{40}$
5	1·58	1·50	1·43	1·38	1·33	1·25	1·19	40·00	25·00	$\frac{5}{40}$
6	1·89	1·80	1·72	1·65	1·59	1·50	1·43	48·00	30·00	$\frac{6}{40}$
7	2·21	2·10	2·00	1·93	1·86	1·75	1·66	56·00	35·00	$\frac{7}{40}$
8	2·52	2·39	2·29	2·20	2·13	2·00	1·90	64·00	40·00	$\frac{8}{40}$
9	2·84	2·69	2·58	2·48	2·39	2·25	2·14	72·00	45·00	$\frac{9}{40}$
10	3·15	2·99	2·86	2·75	2·66	2·50	2·38	80·00	50·00	$\frac{10}{40}$
11	3·47	3·29	3·15	3·03	2·92	2·75	2·61	88·00	55·00	$\frac{11}{40}$
12	3·78	3·59	3·44	3·30	3·19	3·00	2·85	96·00	60·00	$\frac{12}{40}$
13	4·10	3·89	3·72	3·58	3·46	3·25	3·09	104·00	65·00	$\frac{13}{40}$
14	4·41	4·19	4·01	3·86	3·72	3·50	3·33	112·00	70·00	$\frac{14}{40}$
15	4·73	4·49	4·30	4·13	3·99	3·75	3·56	120·00	75·00	$\frac{15}{40}$
16	5·04	4·79	4·58	4·41	4·25	4·00	3·80	128·00	80·00	$\frac{16}{40}$
17	5·36	5·09	4·87	4·68	4·52	4·25	4·04	136·00	85·00	$\frac{17}{40}$
18	5·67	5·39	5·15	4·96	4·78	4·50	4·28	144·00	90·00	$\frac{18}{40}$
19	5·99	5·69	5·44	5·23	5·05	4·75	4·51	152·00	95·00	$\frac{19}{40}$
20	6·30	5·99	5·73	5·51	5·32	5·00	4·75	160·00	100·00	$\frac{20}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

16·68	17·56	18·36	19·10	19·78	21·02	22·12	Uniformly loaded.
13·34	14·05	14·69	15·28	15·82	16·81	17·70	Suspended from the middle.

\* *Example*.—Red Pine 4 feet long, 1·26 in. by  $1\frac{1}{2}$  in., or 1·20 by  $1\frac{3}{4}$ , or 1·15 by 2, or 1·10 by  $2\frac{1}{4}$ , or 1·06 by  $2\frac{1}{2}$ , or 1·00 by 3, or ·95 by  $3\frac{1}{4}$ , with 32 lbs. uniformly loaded, or 20 lbs. suspended from the middle, deflects  $\frac{4}{40}$  of an inch.

The breaking weight of Red Pine 4 ft. long, 1·20 in. by  $1\frac{1}{2}$  in., is  $17·56 \times 32 = 562$  lbs. uniformly loaded, or  $14·05 \times 20 = 281$  lbs. suspended from the middle. The breaking weight of Red Pine 5 feet long, 1·50 in. by  $1\frac{1}{2}$  in., is  $17·56 \times 40 = 702$  lbs. uniformly loaded, or  $14·05 \times 25 = 351$  lbs. suspended from the middle: and so on, throughout the table.



TABLE III.—RED PINE.

WEIGHT upon each foot in length, 15·625 lbs. or ·1395 of a cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

$$\text{Weight uniformly loaded } \dots\dots\dots \frac{W}{D} = 625 = 5 \cdot 58 = \cdot 279$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 390 = 3 \cdot 48 = \cdot 174$$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·39	·37	·36	·34	·33	·31	·30	·13	·08	$\frac{1}{40}$
2	·79	·75	·72	·69	·66	·63	·59	·27	·17	$\frac{2}{40}$
3	1·18	1·12	1·07	1·03	1·00	·94	·89	·41	·26	$\frac{3}{40}$
4	1·58	1·50	1·43	1·38	1·33	1·25	1·19	·55	·34	$\frac{4}{40}$
*5	1·97	1·87	1·79	1·72	1·66	1·56	1·49	·69	·43	$\frac{5}{40}$
6	2·36	2·25	2·15	2·07	1·99	1·88	1·78	·83	·52	$\frac{6}{40}$
7	2·76	2·62	2·51	2·41	2·33	2·19	2·08	·97	·61	$\frac{7}{40}$
8	3·15	2·99	2·86	2·75	2·66	2·50	2·38	1·11	·69	$\frac{8}{40}$
9	3·55	3·37	3·22	3·10	2·99	2·81	2·67	1·25	·78	$\frac{9}{40}$
10	3·94	3·74	3·58	3·44	3·32	3·13	2·97	1·39	·87	$\frac{10}{40}$
11	4·33	4·12	3·94	3·79	3·65	3·44	3·27	1·53	·95	$\frac{11}{40}$
12	4·73	4·49	4·30	4·13	3·99	3·75	3·56	1·67	1·04	$\frac{12}{40}$
13	5·12	4·86	4·65	4·47	4·32	4·06	3·86	1·81	1·13	$\frac{13}{40}$
14	5·52	5·24	5·01	4·82	4·65	4·38	4·16	1·95	1·22	$\frac{14}{40}$
15	5·91	5·61	5·37	5·16	4·98	4·69	4·46	2·09	1·30	$\frac{15}{40}$
16	6·30	5·99	5·73	5·51	5·32	5·00	4·75	2·23	1·39	$\frac{16}{40}$
17	6·70	6·36	6·08	5·85	5·65	5·32	5·05	2·37	1·48	$\frac{17}{40}$
18	7·09	6·74	6·44	6·20	5·98	5·63	5·35	2·51	1·56	$\frac{18}{40}$
19	7·49	7·12	6·80	6·54	6·31	5·94	5·64	2·65	1·65	$\frac{19}{40}$
20	7·88	7·48	7·16	6·88	6·65	6·25	5·94	2·79	1·74	$\frac{20}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

13·34	14·05	14·69	15·28	15·82	16·81	17·70	Uniformly loaded.
10·67	11·24	11·75	12·22	12·66	13·45	14·16	Suspended from the middle.

\* *Example*.—Red Pine 5 feet long, 1·97 in. by 1½ in., or 1·87 by 1¾, or 1·79 by 2, or 1·72 by 2¼, or 1·66 by 2½, or 1·56 by 3, or 1·49 by 3½, with ·69 cwt. uniformly loaded, or ·43 cwt. suspended from the middle, deflects  $\frac{5}{40}$  of an inch.

The breaking weight of Red Pine 5 ft. long, 1·79 in. by 2 in., is 14·69 × ·69 = 10·1 cwt. uniformly loaded, or 11·75 × ·43 = 5·0 cwt. suspended from the middle. The breaking weight of Red Pine 6 feet long, 2·15 in. by 2 in., is 14·69 × ·83 = 12·2 cwt. uniformly loaded, or 11·75 × ·52 = 6·1 cwt. suspended from the middle, and so on, throughout the table.

TABLE IV.—RED PINE.

WEIGHT upon each foot in length 27 lbs. or  $\cdot 241$  of a cwt.DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \begin{matrix} \text{lbs.} \\ 1080 \end{matrix} = \begin{matrix} \text{cwt.} \\ 9\cdot64 \end{matrix} = \begin{matrix} \text{ton.} \\ 4\cdot82 \end{matrix}$

Weight suspended from the middle,  $\frac{W}{D} = 675 = 6\cdot02 = 3\cdot01$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·47	·45	·43	·41	·40	·38	·36	·24	·15	$\frac{1}{40}$
2	·95	·90	·86	·83	·80	·75	·71	·48	·30	$\frac{2}{40}$
3	1·42	1·35	1·29	1·24	1·20	1·13	1·07	·72	·45	$\frac{3}{40}$
4	1·89	1·80	1·72	1·65	1·59	1·50	1·43	·96	·60	$\frac{4}{40}$
5	2·36	2·25	2·15	2·07	1·99	1·88	1·78	1·20	·75	$\frac{5}{40}$
*6	2·84	2·69	2·58	2·48	2·39	2·25	2·14	1·44	·90	$\frac{6}{40}$
7	3·31	3·14	3·01	2·89	2·79	2·63	2·49	1·68	1·05	$\frac{7}{40}$
8	3·78	3·59	3·44	3·30	3·19	3·00	2·85	1·92	1·20	$\frac{8}{40}$
9	4·25	4·04	3·87	3·72	3·59	3·38	3·21	2·16	1·35	$\frac{9}{40}$
10	4·73	4·49	4·30	4·13	3·99	3·75	3·56	2·41	1·50	$\frac{10}{40}$
11	5·20	4·94	4·72	4·54	4·39	4·13	3·92	2·65	1·65	$\frac{11}{40}$
12	5·67	5·39	5·15	4·96	4·78	4·50	4·28	2·89	1·80	$\frac{12}{40}$
13	6·15	5·84	5·58	5·37	5·18	4·88	4·63	3·13	1·95	$\frac{13}{40}$
14	6·62	6·29	6·01	5·78	5·58	5·25	4·99	3·37	2·10	$\frac{14}{40}$
15	7·09	6·74	6·44	6·20	5·98	5·63	5·35	3·61	2·26	$\frac{15}{40}$
16	7·56	7·18	6·87	6·61	6·38	6·00	5·70	3·85	2·41	$\frac{16}{40}$
17	8·04	7·63	7·30	7·02	6·78	6·38	6·06	4·09	2·56	$\frac{17}{40}$
18	8·51	8·08	7·73	7·43	7·18	6·75	6·42	4·33	2·71	$\frac{18}{40}$
19	8·98	8·53	8·16	7·85	7·58	7·13	6·77	4·58	2·86	$\frac{19}{40}$
20	9·45	8·98	8·59	8·26	7·97	7·50	7·13	4·82	3·01	$\frac{20}{40}$
21	9·93	9·43	9·02	8·67	8·37	7·88	7·48	5·06	3·16	$\frac{21}{40}$
22	10·40	9·88	9·45	9·09	8·77	8·25	7·84	5·30	3·31	$\frac{22}{40}$
23	10·87	10·33	9·88	9·50	9·17	8·63	8·20	5·54	3·46	$\frac{23}{40}$
24	11·35	10·78	10·31	9·91	9·57	9·01	8·55	5·78	3·61	$\frac{24}{40}$
25	11·82	11·23	10·74	10·33	9·97	9·38	8·91	6·02	3·76	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

11·12	11·70	12·24	12·73	13·18	14·01	14·75	Uniformly loaded.
8·89	9·36	9·79	10·19	10·55	11·21	11·80	Suspended from the middle.

\* *Example.*—Red Pine 6 feet long. 2·84 in. by  $1\frac{1}{2}$  in., or 2·69 by  $1\frac{3}{4}$ , or 2·58 by 2, or 2·48 by  $2\frac{1}{4}$ , or 2·39 by  $2\frac{1}{2}$ , or 2·25 by 3, or 2·14 by  $3\frac{1}{2}$ , with 1·44 cwt. uniformly loaded, or ·90 cwt. suspended from the middle, deflects  $\frac{6}{40}$  of an inch.

The breaking weight of Red Pine 6 ft. long 2·48 in. by  $2\frac{1}{4}$  in., is  $12\cdot73 \times 1\cdot44 = 18\cdot3$  cwt. uniformly loaded, or  $10\cdot19 \times \cdot90 = 9\cdot1$  cwt. suspended from the middle.

TABLE V.—RED PINE.

WEIGHT upon each foot in length, 42·875 lbs. or ·3828 of a cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded, .....  $\frac{W}{D} = 1715 = 15 \cdot 31 = \cdot 765$ Weight suspended from the middle,  $\frac{W}{D} = 1071 = 9 \cdot 57 = \cdot 478$ 

Length in feet, clear bearing	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·55	·52	·50	·48	·47	·44	·42	·38	·23	$\frac{1}{40}$
2	1·10	1·05	1·00	·96	·93	·88	·83	·76	·47	$\frac{2}{40}$
3	1·65	1·57	1·50	1·45	1·40	1·31	1·25	1·14	·71	$\frac{3}{40}$
4	2·21	2·10	2·00	1·93	1·86	1·75	1·66	1·53	·95	$\frac{4}{40}$
5	2·76	2·62	2·51	2·41	2·33	2·19	2·08	1·91	1·19	$\frac{5}{40}$
6	3·31	3·14	3·01	2·89	2·79	2·63	2·49	2·29	1·43	$\frac{6}{40}$
*7	3·86	3·67	3·51	3·37	3·26	3·06	2·91	2·67	1·67	$\frac{7}{40}$
8	4·41	4·19	4·01	3·86	3·72	3·50	3·33	3·06	1·91	$\frac{8}{40}$
9	4·96	4·71	4·51	4·34	4·19	3·94	3·74	3·44	2·15	$\frac{9}{40}$
10	5·52	5·24	5·01	4·82	4·65	4·38	4·16	3·82	2·39	$\frac{10}{40}$
11	6·07	5·76	5·51	5·30	5·12	4·82	4·57	4·21	2·63	$\frac{11}{40}$
12	6·62	6·29	6·01	5·78	5·58	5·25	4·99	4·59	2·87	$\frac{12}{40}$
13	7·17	6·81	6·51	6·26	6·05	5·69	5·41	4·97	3·11	$\frac{13}{40}$
14	7·72	7·33	7·01	6·75	6·51	6·13	5·82	5·35	3·34	$\frac{14}{40}$
15	8·27	7·86	7·52	7·23	6·98	6·57	6·24	5·74	3·58	$\frac{15}{40}$
16	8·82	8·38	8·02	7·71	7·44	7·00	6·65	6·12	3·82	$\frac{16}{40}$
17	9·38	8·91	8·52	8·19	7·91	7·44	7·07	6·50	4·06	$\frac{17}{40}$
18	9·93	9·43	9·02	8·67	8·37	7·88	7·48	6·89	4·30	$\frac{18}{40}$
19	10·48	9·95	9·52	9·16	8·84	8·32	7·90	7·27	4·54	$\frac{19}{40}$
20	11·03	10·48	10·02	9·64	9·30	8·75	8·32	7·65	4·78	$\frac{20}{40}$
21	11·58	11·00	10·52	10·12	9·77	9·19	8·73	8·03	5·02	$\frac{21}{40}$
22	12·13	11·53	11·02	10·60	10·23	9·63	9·15	8·42	5·26	$\frac{22}{40}$
23	12·69	12·05	11·52	11·08	10·70	10·07	9·56	8·80	5·50	$\frac{23}{40}$
24	13·24	12·57	12·02	11·57	11·16	10·51	9·98	9·18	5·74	$\frac{24}{40}$
25	13·79	13·10	12·53	12·05	11·63	10·94	10·40	9·57	5·98	$\frac{25}{40}$

Multipliers to give the breaking weight of every Scantling in each column respectively.

9·53	10·03	10·49	10·91	11·30	12·01	12·64	Uniformly loaded.
7·62	8·02	8·39	8·73	9·04	9·61	10·11	Suspended from the middle.

\* Example.—Red Pine 7 feet long, 3·86 in. by  $1\frac{1}{2}$  in., or 3·67 by  $1\frac{3}{4}$ , or 3·51 by 2, or 3·37 by  $2\frac{1}{4}$ , or 3·26 by  $2\frac{1}{2}$ , or 3·06 by 3, or 2·91 by  $3\frac{1}{2}$ , with 2·67 cwt. uniformly loaded, or 1·67 cwt. suspended from the middle, deflects  $\frac{7}{40}$  of an inch.

The breaking weight of Red Pine 7 feet long 3·26 in. by  $2\frac{1}{2}$  in. is  $11 \cdot 30 \times 2 \cdot 67 = 30 \cdot 1$  cwt. uniformly loaded, or  $9 \cdot 04 \times 1 \cdot 67 = 15 \cdot 0$  cwt. suspended from the middle.

TABLE VI.—RED PINE.

WEIGHT upon each foot in length, 64lbs. or  $\cdot 5714$  of a cwt.DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{2560} = \frac{\text{cwts.}}{22\cdot 85} = \frac{\text{tons.}}{1\cdot 142}$

Weight suspended from the middle,  $\frac{W}{D} = 1600 = 14\cdot 28 = \cdot 714$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwts.	Weight (suspended from the middle, in cwts.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·63	·60	·57	·55	·53	·50	·48	·57	·35	$\frac{1}{40}$
2	1·26	1·20	1·15	1·10	1·06	1·00	·95	1·14	·71	$\frac{2}{40}$
3	1·89	1·80	1·72	1·65	1·59	1·50	1·43	1·71	1·07	$\frac{3}{40}$
4	2·52	2·39	2·29	2·20	2·13	2·00	1·90	2·28	1·42	$\frac{4}{40}$
5	3·15	2·99	2·86	2·75	2·66	2·50	2·38	2·85	1·78	$\frac{5}{40}$
6	3·78	3·59	3·44	3·30	3·19	3·00	2·85	3·42	2·14	$\frac{6}{40}$
7	4·41	4·19	4·01	3·86	3·72	3·50	3·33	4·00	2·50	$\frac{7}{40}$
*8	5·04	4·79	4·58	4·41	4·25	4·00	3·80	4·57	2·85	$\frac{8}{40}$
9	5·67	5·39	5·15	4·96	4·78	4·50	4·28	5·14	3·21	$\frac{9}{40}$
10	6·30	5·99	5·73	5·51	5·32	5·00	4·75	5·71	3·57	$\frac{10}{40}$
11	6·93	6·59	6·30	6·06	5·85	5·50	5·23	6·28	3·92	$\frac{11}{40}$
12	7·56	7·18	6·87	6·61	6·38	6·00	5·70	6·85	4·28	$\frac{12}{40}$
13	8·19	7·78	7·44	7·16	6·91	6·50	6·18	7·42	4·64	$\frac{13}{40}$
14	8·82	8·38	8·02	7·71	7·44	7·00	6·65	8·00	5·00	$\frac{14}{40}$
15	9·45	8·98	8·59	8·26	7·97	7·50	7·13	8·57	5·35	$\frac{15}{40}$
16	10·09	9·58	9·16	8·81	8·51	8·00	7·60	9·14	5·71	$\frac{16}{40}$
17	10·72	10·18	9·74	9·36	9·04	8·50	8·08	9·71	6·07	$\frac{17}{40}$
18	11·35	10·78	10·31	9·91	9·57	9·01	8·55	10·28	6·42	$\frac{18}{40}$
19	11·98	11·38	10·88	10·46	10·10	9·51	9·03	10·85	6·78	$\frac{19}{40}$
20	12·61	11·97	11·45	11·01	10·63	10·01	9·50	11·42	7·14	$\frac{20}{40}$
21	13·24	12·57	12·03	11·57	11·16	10·51	9·98	12·00	7·50	$\frac{21}{40}$
22	13·87	13·17	12·60	12·12	11·70	11·01	10·45	12·57	7·85	$\frac{22}{40}$
23	14·50	13·77	13·17	12·67	12·23	11·51	10·93	13·14	8·21	$\frac{23}{40}$
24	15·13	14·37	13·74	13·22	12·76	12·01	11·40	13·71	8·57	$\frac{24}{40}$
25	15·76	14·97	14·32	13·77	13·29	12·51	11·88	14·28	8·92	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every scantling in each column respectively.

8·34	8·78	9·18	9·55	9·89	10·51	11·06	Uniformly loaded.
6·67	7·02	7·34	7·64	7·91	8·40	8·85	Suspended from the middle.

\* *Example*.—Red Pine 8 feet long, 5·04 in. by  $1\frac{1}{2}$  in., or 4·79 by  $1\frac{3}{4}$ , or 4·58 by 2, or 4·41 by  $2\frac{1}{4}$ , or 4·25 by  $2\frac{1}{2}$ , or 4 by 3, or 3·80 by  $3\frac{1}{2}$ , with 4·57 cwts. uniformly loaded, or 2·85 cwts. suspended from the middle, deflects  $\frac{8}{40}$  of an inch.

The breaking weight of Red Pine 8 ft. long, 4·25 in. by  $2\frac{1}{2}$  in. is  $9\cdot 89 \times 4\cdot 57 = 45\cdot 1$  cwts. uniformly loaded, or  $7\cdot 91 \times 2\cdot 85 = 22\cdot 5$  cwts. suspended from the middle.



TABLE VII.—RED PINE.

WEIGHT upon each foot in length, 91·125 lbs. or ·8136 of a cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded, .....  $\frac{W}{D} = 3645 = 32\cdot54 = 1\cdot627$ Weight suspended from the middle,  $\frac{W}{D} = 2278 = 20\cdot34 = 1\cdot017$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
DEPTH IN INCHES.										
1	·71	·67	·64	·62	·60	·56	·53	·81	·50	$\frac{1}{40}$
2	1·42	1·35	1·29	1·24	1·20	1·13	1·07	1·62	1·01	$\frac{2}{40}$
3	2·13	2·02	1·93	1·86	1·79	1·69	1·60	2·44	1·52	$\frac{3}{40}$
4	2·84	2·69	2·58	2·48	2·39	2·25	2·14	3·25	2·03	$\frac{4}{40}$
5	3·55	3·37	3·22	3·10	2·99	2·81	2·67	4·06	2·54	$\frac{5}{40}$
6	4·25	4·04	3·87	3·72	3·59	3·38	3·21	4·88	3·05	$\frac{6}{40}$
7	4·96	4·71	4·51	4·34	4·19	3·94	3·74	5·69	3·56	$\frac{7}{40}$
8	5·67	5·39	5·15	4·96	4·78	4·50	4·28	6·50	4·06	$\frac{8}{40}$
*9	6·38	6·06	5·80	5·58	5·38	5·07	4·81	7·32	4·57	$\frac{9}{40}$
10	7·09	6·74	6·44	6·20	5·98	5·63	5·35	8·13	5·08	$\frac{10}{40}$
11	7·80	7·41	7·09	6·82	6·58	6·19	5·88	8·94	5·59	$\frac{11}{40}$
12	8·51	8·08	7·73	7·43	7·18	6·75	6·42	9·76	6·10	$\frac{12}{40}$
13	9·22	8·76	8·38	8·05	7·77	7·32	6·95	10·57	6·61	$\frac{13}{40}$
14	9·93	9·43	9·02	8·67	8·37	7·88	7·48	11·39	7·11	$\frac{14}{40}$
15	10·64	10·10	9·66	9·29	8·97	8·44	8·02	12·20	7·62	$\frac{15}{40}$
16	11·35	10·78	10·31	9·91	9·57	9·00	8·55	13·01	8·13	$\frac{16}{40}$
17	12·05	11·45	10·95	10·53	10·17	9·57	9·09	13·83	8·64	$\frac{17}{40}$
18	12·76	12·12	11·60	11·15	10·76	10·13	9·62	14·64	9·15	$\frac{18}{40}$
19	13·47	12·80	12·24	11·77	11·36	10·69	10·16	15·45	9·66	$\frac{19}{40}$
20	14·18	13·47	12·89	12·39	11·96	11·26	10·69	16·27	10·17	$\frac{20}{40}$
21	14·89	14·14	13·53	13·01	12·56	11·82	11·23	17·08	10·67	$\frac{21}{40}$
22	...	14·82	14·17	13·63	13·16	12·38	11·76	17·89	11·18	$\frac{22}{40}$
23	...	...	14·82	14·25	13·76	12·94	12·30	18·71	11·69	$\frac{23}{40}$
24	...	...	...	14·87	14·35	13·51	12·83	19·52	12·20	$\frac{24}{40}$
25	...	...	...	...	14·95	14·07	13·37	20·34	12·71	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·416	7·806	8·162	8·492	8·791	9·343	9·835	Uniformly loaded.
5·933	6·245	6·530	6·793	7·033	7·474	7·868	Suspended from the middle.

\* *Example.*—Red Pine 9 feet long, 6·38 in. by 1½ in., or 6·06 by 1¾, or 5·80 by 2, or 5·58 by 2¼, or 5·38 by 2½, or 5·07 by 3, or 4·81 by 3½, with 7·32 cwt. uniformly loaded, or 4·57 cwt. suspended from the middle, deflects  $\frac{9}{40}$  of an inch.

The breaking weight of Red Pine 9 feet long, 4·81 in. by 3½ in. is  $9·835 \times 7·32 = 71·9$  cwt. uniformly loaded, or  $7·868 \times 4·57 = 35·9$  cwt. suspended from the middle.

## TABLE VIII.—RED PINE.

WEIGHT upon each foot in length, 125 lbs., or 1.116 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 5000 = 44.64 = 2.232$

lbs.      cwt.      tons.

Weight suspended from the middle,  $\frac{W}{D} = 3125 = 27.90 = 1.395$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·79	·75	·72	·69	·66	·63	·59	1·11	·69	$\frac{1}{40}$
2	1·58	1·50	1·43	1·38	1·33	1·25	1·19	2·23	1·39	$\frac{2}{40}$
3	2·36	2·25	2·15	2·07	1·99	1·88	1·78	3·34	2·09	$\frac{3}{40}$
4	3·15	2·99	2·86	2·75	2·66	2·50	2·38	4·46	2·79	$\frac{4}{40}$
5	3·94	3·74	3·58	3·44	3·32	3·13	2·97	5·58	3·48	$\frac{5}{40}$
6	4·73	4·49	4·30	4·13	3·99	3·75	3·56	6·69	4·18	$\frac{6}{40}$
7	5·52	5·24	5·01	4·82	4·65	4·38	4·16	7·81	4·88	$\frac{7}{40}$
8	6·30	5·99	5·73	5·51	5·32	5·00	4·75	8·92	5·58	$\frac{8}{40}$
9	7·09	6·74	6·44	6·20	5·98	5·63	5·35	10·04	6·27	$\frac{9}{40}$
*10	7·88	7·48	7·16	6·88	6·65	6·25	5·94	11·16	6·97	$\frac{10}{40}$
11	8·67	8·23	7·87	7·57	7·31	6·88	6·53	12·27	7·67	$\frac{11}{40}$
12	9·45	8·98	8·59	8·26	7·97	7·50	7·13	13·39	8·37	$\frac{12}{40}$
13	10·24	9·73	9·31	8·95	8·64	8·13	7·72	14·50	9·06	$\frac{13}{40}$
14	11·03	10·48	10·02	9·64	9·30	8·75	8·32	15·62	9·76	$\frac{14}{40}$
15	11·82	11·23	10·74	10·33	9·97	9·38	8·91	16·74	10·46	$\frac{15}{40}$
16	12·61	11·97	11·45	11·01	10·63	10·01	9·50	17·85	11·16	$\frac{16}{40}$
17	13·39	12·72	12·17	11·70	11·30	10·63	10·10	18·97	11·85	$\frac{17}{40}$
18	14·18	13·47	12·89	12·39	11·96	11·26	10·69	20·08	12·55	$\frac{18}{40}$
19	14·97	14·22	13·60	13·08	12·63	11·88	11·29	21·20	13·25	$\frac{19}{40}$
20	...	14·97	14·32	13·77	13·29	12·51	11·88	22·32	13·95	$\frac{20}{40}$
21	...	...	15·03	14·46	13·95	13·13	12·47	23·43	14·64	$\frac{21}{40}$
22	...	...	...	15·14	14·62	13·76	13·07	24·55	15·34	$\frac{22}{40}$
23	...	...	...	...	15·28	14·38	13·66	25·66	16·04	$\frac{23}{40}$
24	...	...	...	...	...	15·01	14·26	26·78	16·74	$\frac{24}{40}$
25	...	...	...	...	...	15·63	14·85	27·90	17·43	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

6.674	7.025	7.346	7.642	7.912	8.409	8.851	Uniformly loaded.
5.339	5.620	5.877	6.114	6.330	6.727	7.081	Suspended from the middle

\* *Example*.—Red Pine 10 feet long, 7.88 in. by 1½ in., or 7.48 by 1¾, or 7.16 by 2, or 6.88 by 2¼, or 6.65 by 2½, or 6.25 by 3, or 5.94 by 3½, with 11.16 cwt. uniformly loaded, or 6.97 cwt. suspended from the middle, deflects  $\frac{10}{40}$  of an inch.

The breaking weight of Red Pine 10 feet long, 6.25 in. by 3 in., is 8.409 × 11.16 = 93.8 cwt. uniformly loaded, or 6.727 × 6.97 = 46.9 cwt. suspended from the middle.

TABLE IX.—RED PINE.

WEIGHT upon each foot in length, 166·375 lbs., or 1·4854 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded .....  $\frac{W}{D} = 6655 = 59\cdot41 = 2\cdot970$ Weight suspended from the middle,  $\frac{W}{D} = 4159 = 37\cdot13 = 1\cdot856$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	1½	1¾	2	2¼	2½	3	3½			
	DEPTH IN INCHES.									
1	·87	·82	·79	·76	·73	·69	·65	1·48	·92	$\frac{1}{40}$
2	1·73	1·65	1·57	1·51	1·46	1·38	1·31	2·97	1·85	$\frac{2}{40}$
3	2·60	2·47	2·36	2·27	2·19	2·06	1·96	4·45	2·78	$\frac{3}{40}$
4	3·47	3·29	3·15	3·03	2·92	2·75	2·61	5·94	3·71	$\frac{4}{40}$
5	4·33	4·12	3·94	3·79	3·65	3·44	3·27	7·42	4·64	$\frac{5}{40}$
6	5·20	4·94	4·72	4·54	4·39	4·13	3·92	8·91	5·57	$\frac{6}{40}$
7	6·07	5·76	5·51	5·30	5·12	4·82	4·57	10·39	6·49	$\frac{7}{40}$
8	6·93	6·59	6·30	6·06	5·85	5·50	5·23	11·88	7·42	$\frac{8}{40}$
9	7·80	7·41	7·09	6·82	6·58	6·19	5·88	13·36	8·35	$\frac{9}{40}$
10	8·67	8·23	7·87	7·57	7·31	6·88	6·53	14·85	9·28	$\frac{10}{40}$
* 11	9·53	9·06	8·66	8·33	8·04	7·57	7·19	16·34	10·21	$\frac{11}{40}$
12	10·40	9·88	9·45	9·09	8·77	8·25	7·84	17·82	11·14	$\frac{12}{40}$
13	11·27	10·70	10·24	9·84	9·50	8·94	8·49	19·31	12·06	$\frac{13}{40}$
14	12·13	11·53	11·02	10·60	10·23	9·63	9·15	20·79	13·00	$\frac{14}{40}$
15	13·00	12·35	11·81	11·36	10·96	10·32	9·80	22·28	13·92	$\frac{15}{40}$
16	13·87	13·17	12·60	12·12	11·70	11·01	10·45	23·76	14·85	$\frac{16}{40}$
17	14·73	14·00	13·39	12·87	12·43	11·69	11·11	25·25	15·78	$\frac{17}{40}$
18	...	14·82	14·17	13·63	13·16	12·38	11·76	26·73	16·71	$\frac{18}{40}$
19	...	...	14·96	14·39	13·89	13·07	12·41	28·22	17·64	$\frac{19}{40}$
20	...	...	...	15·14	14·62	13·76	13·07	29·70	18·56	$\frac{20}{40}$
21	...	...	...	...	15·35	14·45	13·72	31·19	19·49	$\frac{21}{40}$
22	...	...	...	...	...	15·13	14·37	32·68	20·42	$\frac{22}{40}$
23	...	...	...	...	...	...	15·03	34·16	21·35	$\frac{23}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

6·067	6·387	6·678	6·948	7·193	7·644	8·047	Uniformly loaded.
4·854	5·109	5·342	5·558	5·754	6·115	6·437	Suspended from the middle

\* *Example.*—Red Pine 11 feet long, 9·53 in. by 1½ in., or 9·06 by 1¾, or 8·66 by 2, or 8·33 by 2¼, or 8·04 by 2½, or 7·57 by 3, or 7·19 by 3½, with 16·34 cwt. uniformly loaded, or 10·21 cwt. suspended from the middle, deflects  $\frac{11}{40}$  of an inch.

The breaking weight of Red Pine 11 feet long, 8·04 in. by 2½ in., is 7·193 × 16·34 = 117·5 cwt. uniformly loaded, or 5·754 × 10·21 = 58·7 cwt. suspended from the middle.

## TABLE X.—RED PINE.

WEIGHT upon each foot in length, 216 lbs. or 1·9285 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 8640 = 77 \cdot 14 = 3 \cdot 857$

lbs.      cwt.      tons.

Weight suspended from the middle,  $\frac{W}{D} = 5400 = 48 \cdot 21 = 2 \cdot 410$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	DEPTH IN INCHES.									
1	·95	·90	·86	·83	·80	·75	·71	·68	·66	·63
2	1·89	1·80	1·72	1·65	1·59	1·50	1·43	1·36	1·31	1·27
3	2·84	2·69	2·58	2·48	2·39	2·25	2·14	2·05	1·97	1·90
4	3·78	3·59	3·44	3·30	3·19	3·00	2·85	2·73	2·62	2·53
5	4·73	4·49	4·30	4·13	3·99	3·75	3·56	3·41	3·28	3·16
6	5·67	5·39	5·15	4·96	4·78	4·50	4·28	4·09	3·93	3·80
7	6·62	6·29	6·01	5·78	5·58	5·25	4·99	4·77	4·59	4·43
8	7·56	7·18	6·87	6·61	6·38	6·00	5·70	5·45	5·24	5·06
9	8·51	8·08	7·73	7·43	7·18	6·75	6·42	6·14	5·90	5·70
10	9·45	8·98	8·59	8·26	7·97	7·50	7·13	6·82	6·55	6·33
11	10·40	9·88	9·45	9·09	8·77	8·25	7·84	7·50	7·21	6·96
*12	11·35	10·78	10·31	9·91	9·57	9·01	8·55	8·18	7·87	7·60
13	12·29	11·68	11·17	10·74	10·37	9·76	9·27	8·86	8·52	8·23
14	13·24	12·57	12·03	11·57	11·16	10·51	9·98	9·54	9·18	8·86
15	14·18	13·47	12·89	12·39	11·96	11·26	10·69	10·23	9·83	9·49
16	15·13	14·37	13·74	13·22	12·76	12·01	11·40	10·91	10·49	10·13
17	...	15·27	14·60	14·04	13·56	12·76	12·12	11·59	11·14	10·76
18	...	...	15·46	14·87	14·35	13·51	12·83	12·27	11·80	11·39
19	...	...	...	15·70	15·15	14·26	13·54	12·95	12·45	12·03
20	...	...	...	...	...	15·01	14·26	13·63	13·11	12·66
21	...	...	...	...	...	...	14·97	14·32	13·77	13·29
22	...	...	...	...	...	...	...	15·00	14·42	13·92
23	...	...	...	...	...	...	...	...	15·08	14·56
24	...	...	...	...	...	...	...	...	15·73	15·19
25	...	...	...	...	...	...	...	...	...	15·82
Multipliers to give the <i>breaking weight</i> of every Scantling in each column respectively.										
	5·562	5·854	6·121	6·369	6·593	7·007	7·376	7·712	8·021	8·308
	4·449	4·683	4·897	5·095	5·275	5·606	5·901	6·170	6·417	6·647

\* *Example.*—Red Pine 12 feet long, 11·35 in. by  $1\frac{1}{2}$  in., or 10·78 by  $1\frac{3}{4}$ , or 10·31 by 2, .. or 9·01 by 3, .. or 7·87 by  $4\frac{1}{2}$ , or 7·60 by 5, with ..... 23·14 cwt. uniformly loaded, or 14·46 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The *breaking weight* of Red Pine 12 ft. long, 9·01 in. by 3 in., is  $7·007 \times 23·14 = 162·1$  cwt. uniformly loaded, or  $5·606 \times 14·46 = 81·0$  cwt. suspended from the middle.



TABLE X. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 216 lbs. or 1·9285 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{8640} = \frac{\text{cwt.}}{77\cdot14} = \frac{\text{tons.}}{3\cdot857}$

Weight suspended from the middle,  $\frac{W}{D} = 5400 = 48\cdot21 = 2\cdot410$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	6	7	8	9	10	11	12			
	DEPTH IN INCHES.									
1	·60	·57	·54	·52	·50	·49	·47	1·92	1·20	$\frac{1}{40}$
2	1·19	1·13	1·08	1·04	1·00	·97	·95	3·85	2·41	$\frac{2}{40}$
3	1·79	1·70	1·62	1·56	1·51	1·46	1·42	5·78	3·61	$\frac{3}{40}$
4	2·38	2·26	2·16	2·08	2·01	1·95	1·89	7·71	4·82	$\frac{4}{40}$
5	2·98	2·83	2·71	2·60	2·51	2·43	2·36	9·64	6·02	$\frac{5}{40}$
6	3·57	3·39	3·25	3·12	3·01	2·92	2·84	11·57	7·23	$\frac{6}{40}$
7	4·17	3·96	3·79	3·64	3·52	3·41	3·31	13·50	8·43	$\frac{7}{40}$
8	4·76	4·53	4·33	4·16	4·02	3·89	3·78	15·42	9·64	$\frac{8}{40}$
9	5·36	5·09	4·87	4·68	4·52	4·38	4·25	17·35	10·84	$\frac{9}{40}$
10	5·96	5·66	5·41	5·20	5·02	4·87	4·73	19·28	12·05	$\frac{10}{40}$
11	6·55	6·22	5·95	5·72	5·53	5·35	5·20	21·21	13·25	$\frac{11}{40}$
* 12	7·15	6·79	6·49	6·24	6·03	5·84	5·67	23·14	14·46	$\frac{12}{40}$
13	7·74	7·35	7·03	6·76	6·53	6·33	6·15	25·07	15·66	$\frac{13}{40}$
14	8·34	7·92	7·58	7·28	7·03	6·81	6·62	27·00	16·87	$\frac{14}{40}$
15	8·93	8·49	8·12	7·80	7·53	7·30	7·09	28·92	18·08	$\frac{15}{40}$
16	9·53	9·05	8·66	8·32	8·04	7·79	7·56	30·85	19·28	$\frac{16}{40}$
17	10·13	9·62	9·20	8·84	8·54	8·27	8·04	32·78	20·49	$\frac{17}{40}$
18	10·72	10·18	9·74	9·36	9·04	8·76	8·51	34·71	21·69	$\frac{18}{40}$
19	11·32	10·75	10·28	9·88	9·54	9·25	8·98	36·64	22·90	$\frac{19}{40}$
20	11·91	11·31	10·82	10·40	10·05	9·73	9·45	38·57	24·10	$\frac{20}{40}$
21	12·51	11·88	11·36	10·92	10·55	10·22	9·93	40·50	25·31	$\frac{21}{40}$
22	13·10	12·45	11·90	11·44	11·05	10·71	10·40	42·42	26·51	$\frac{22}{40}$
23	13·70	13·01	12·45	11·96	11·55	11·19	10·87	44·35	27·72	$\frac{23}{40}$
24	14·29	13·58	12·99	12·48	12·06	11·68	11·35	46·28	28·92	$\frac{24}{40}$
25	14·89	14·14	13·53	13·01	12·56	12·17	11·82	48·21	30·13	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

8·829	9·293	9·717	10·10	10·46	10·80	11·12	Uniformly loaded.
7·063	7·434	7·774	8·08	8·37	8·64	8·89	Suspended from the middle.

\* *Example.*—Red Pine 12 feet long, 7·15 in. by 6 in., or 6·79 by 7, or 6·49 by 8, or 6·24 by 9, or 6·03 by 10, or 5·84 by 11, or 5·67 by 12, with 23·14 cwt. uniformly loaded, or 14·46 cwt. suspended from the middle, deflects  $\frac{12}{40}$  of an inch.

The breaking weight of Red Pine 12 ft. long, 7·15 in. by 6 in., is 8·829 × 23·14 = 204·3 cwt., uniformly loaded, or 7·063 × 14·46 = 102·1 cwt. suspended from the middle.

TABLE XI.—RED PINE.

WEIGHT upon each foot in length, 274.625 lbs., or 2.452 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = \frac{\text{lbs.}}{\text{D}} = 10985 = \frac{\text{cwt.}}{98.08} = \frac{\text{tons.}}{4.904}$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 6865 = 61.30 = 3.065$$

Length in feet, clear bearing	BREADTH IN INCHES.									
	1½	1¾	2	2¼	2½	3	3½	4	4½	5
	DEPTH IN INCHES.									
1	1.02	.97	.93	.89	.86	.81	.77	.74	.71	.69
2	2.05	1.95	1.86	1.79	1.73	1.63	1.54	1.48	1.42	1.37
3	3.07	2.92	2.79	2.68	2.59	2.44	2.32	2.22	2.13	2.06
4	4.10	3.89	3.72	3.58	3.46	3.25	3.09	2.95	2.84	2.74
5	5.12	4.86	4.65	4.47	4.32	4.06	3.86	3.69	3.55	3.43
6	6.15	5.84	5.58	5.37	5.18	4.88	4.63	4.43	4.26	4.11
7	7.17	6.81	6.51	6.26	6.05	5.69	5.41	5.17	4.97	4.80
8	8.19	7.78	7.44	7.16	6.91	6.50	6.18	5.91	5.68	5.49
9	9.22	8.76	8.38	8.05	7.77	7.32	6.95	6.65	6.39	6.17
10	10.24	9.73	9.31	8.95	8.64	8.13	7.72	7.39	7.10	6.86
11	11.27	10.70	10.24	9.84	9.50	8.94	8.49	8.12	7.81	7.54
12	12.29	11.68	11.17	10.74	10.37	9.76	9.27	8.86	8.52	8.23
*13	13.32	12.65	12.10	11.63	11.23	10.57	10.04	9.60	9.23	8.91
14	14.34	13.62	13.03	12.53	12.09	11.38	10.81	10.34	9.94	9.60
15	...	14.59	13.96	13.42	12.96	12.19	11.58	11.08	10.65	10.29
16	...	...	14.89	14.32	13.82	13.01	12.36	11.82	11.36	10.97
17	...	...	...	15.21	14.69	13.82	13.13	12.56	12.07	11.66
18	...	...	...	...	15.55	14.63	13.90	13.29	12.78	12.34
19	...	...	...	...	...	15.45	14.67	14.03	13.49	13.03
20	...	...	...	...	...	...	15.44	14.77	14.20	13.71
21	...	...	...	...	...	...	...	15.51	14.91	14.40
22	...	...	...	...	...	...	...	...	15.62	15.08
23	...	...	...	...	...	...	...	...	...	15.77
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

5.134	5.404	5.651	5.879	6.086	6.468	6.809	7.119	7.404	7.669
4.107	4.323	4.520	4.703	4.869	5.174	5.447	5.695	5.923	6.135

\* *Example.*—Red Pine 13 feet long, 13.32 in. by 1½ in., or 12.65 by 1¾, or 12.10 by 2, .. or 10.57 by 3, .. or 9.23 by 4½, or 8.91 by 5, with ..... 31.87 cwt. uniformly loaded, or 19.92 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The breaking weight of Red Pine 13 feet long, 10.04 in. by 3½ in., is 6.809 × 31.87 = 217.0 cwt. uniformly loaded, or 5.447 × 19.92 = 108.5 cwt. suspended from the middle.

TABLE XI. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 274·625 lbs., or 2·452 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded .....  $\frac{W}{D} = 10985 = 98\cdot08 = 4\cdot904$ Weight suspended from the middle,  $\frac{W}{D} = 6865 = 61\cdot30 = 3\cdot065$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	6	7	8	9	10	11	12			
	DEPTH IN INCHES.									
1	·65	·61	·59	·56	·54	·53	·51	2·45	1·53	$\frac{1}{40}$
2	1·29	1·23	1·17	1·13	1·09	1·05	1·02	4·90	3·06	$\frac{2}{40}$
3	1·94	1·84	1·76	1·69	1·63	1·58	1·54	7·35	4·59	$\frac{3}{40}$
4	2·58	2·45	2·34	2·25	2·18	2·11	2·05	9·80	6·13	$\frac{4}{40}$
5	3·23	3·06	2·93	2·82	2·72	2·64	2·56	12·26	7·66	$\frac{5}{40}$
6	3·87	3·68	3·52	3·38	3·27	3·16	3·07	14·71	9·19	$\frac{6}{40}$
7	4·52	4·29	4·10	3·95	3·81	3·69	3·58	17·16	10·72	$\frac{7}{40}$
8	5·16	4·90	4·69	4·51	4·35	4·22	4·10	19·61	12·26	$\frac{8}{40}$
9	5·81	5·52	5·28	5·07	4·90	4·75	4·61	22·06	13·79	$\frac{9}{40}$
10	6·45	6·13	5·86	5·64	5·44	5·27	5·12	24·52	15·32	$\frac{10}{40}$
11	7·10	6·74	6·45	6·20	5·99	5·80	5·63	26·97	16·85	$\frac{11}{40}$
12	7·74	7·35	7·03	6·76	6·53	6·33	6·15	29·42	18·39	$\frac{12}{40}$
*13	8·39	7·97	7·62	7·33	7·07	6·85	6·66	31·87	19·92	$\frac{13}{40}$
14	9·03	8·58	8·21	7·89	7·62	7·38	7·17	34·32	21·45	$\frac{14}{40}$
15	9·68	9·19	8·79	8·45	8·16	7·91	7·68	36·78	22·98	$\frac{15}{40}$
16	10·32	9·81	9·38	9·02	8·71	8·44	8·19	39·23	24·52	$\frac{16}{40}$
17	10·97	10·42	9·97	9·58	9·25	8·96	8·71	41·68	26·05	$\frac{17}{40}$
18	11·61	11·03	10·55	10·14	9·80	9·49	9·22	44·13	27·58	$\frac{18}{40}$
19	12·26	11·64	11·14	10·71	10·34	10·02	9·73	46·58	29·11	$\frac{19}{40}$
20	12·90	12·26	11·72	11·27	10·88	10·55	10·24	49·04	30·65	$\frac{20}{40}$
21	13·55	12·87	12·31	11·84	11·43	11·07	10·75	51·49	32·18	$\frac{21}{40}$
22	14·20	13·48	12·90	12·40	11·97	11·60	11·27	53·94	33·71	$\frac{22}{40}$
23	14·84	14·10	13·48	12·96	12·52	12·13	11·78	56·39	35·24	$\frac{23}{40}$
24	15·49	14·71	14·07	13·53	13·06	12·65	12·29	58·84	36·78	$\frac{24}{40}$
25	16·13	15·32	14·66	14·09	13·60	13·18	12·80	61·30	38·31	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

8·150	8·578	8·970	9·328	9·662	9·975	10·26	Uniformly loaded.
6·520	6·862	7·176	7·462	7·729	7·980	8·21	Suspended from the middle

\* *Example.*—Red Pine 13 feet long, 8·39 in. by 6 in., or 7·97 by 7, or 7·62 by 8, or 7·33 by 9, or 7·07 by 10, or 6·85 by 11, or 6·66 by 12, with 31·87 cwt. uniformly loaded, or 19·92 cwt. suspended from the middle, defects  $\frac{13}{40}$  of an inch.

The breaking weight of Red Pine 13 feet long, 7·97 in. by 7 in., is  $8\cdot578 \times 31\cdot87 = 273\cdot3$  cwt. uniformly loaded, or  $6\cdot862 \times 19\cdot92 = 136\cdot6$  cwt. suspended from the middle.



TABLE XII.—RED PINE.

WEIGHT upon each foot in length, 343 lbs. or 3·0625 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded, .....  $\frac{W}{D} = \frac{\text{lbs.}}{13720} = \frac{\text{cwt.}}{122\cdot50} = \frac{\text{tons.}}{6\cdot125}$

Weight suspended from the middle,  $\frac{W}{D} = 8575 = 76\cdot56 = 3\cdot828$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	1½	1¾	2	2¼	2½	3	3½	4	4½	5
	DEPTH IN INCHES.									
1	1·10	1·05	1·00	·96	·93	·88	·83	·80	·76	·74
2	2·21	2·10	2·00	1·93	1·86	1·75	1·66	1·59	1·53	1·48
3	3·31	3·14	3·01	2·89	2·79	2·63	2·49	2·39	2·29	2·22
4	4·41	4·19	4·01	3·86	3·72	3·50	3·33	3·18	3·06	2·95
5	5·52	5·24	5·01	4·82	4·65	4·38	4·16	3·98	3·82	3·69
6	6·62	6·29	6·01	5·78	5·58	5·25	4·99	4·77	4·59	4·43
7	7·72	7·33	7·02	6·75	6·51	6·13	5·82	5·57	5·35	5·17
8	8·82	8·38	8·02	7·71	7·44	7·00	6·65	6·36	6·12	5·91
9	9·93	9·43	9·02	8·67	8·37	7·88	7·48	7·16	6·88	6·65
10	11·03	10·48	10·02	9·64	9·30	8·75	8·32	7·95	7·65	7·38
11	12·13	11·53	11·02	10·60	10·23	9·63	9·15	8·75	8·41	8·12
12	13·24	12·57	12·03	11·57	11·16	10·51	9·98	9·54	9·18	8·86
13	14·34	13·62	13·03	12·53	12·09	11·38	10·81	10·34	9·94	9·60
*14	...	14·67	14·03	13·49	13·02	12·26	11·64	11·13	10·71	10·34
15	...	...	15·03	14·46	13·95	13·13	12·47	11·93	11·47	11·08
16	...	...	...	...	14·88	14·01	13·31	12·73	12·24	11·81
17	...	...	...	...	...	14·88	14·14	13·52	13·00	12·55
18	...	...	...	...	...	...	14·97	14·32	13·77	13·29
19	...	...	...	...	...	...	...	15·11	14·53	14·03
20	...	...	...	...	...	...	...	...	15·30	14·77
21	...	...	...	...	...	...	...	...	...	15·51
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·767	5·018	5·247	5·459	5·651	6·006	6·322	6·610	6·875	7·121
3·814	4·014	4·197	4·367	4·521	4·804	5·058	5·288	5·500	5·697

\* *Example.*—Red Pine 14 feet long, . 14·67 in. by 1½ in., or 14·03 by 2, .. or 12·26 by 3, .. or 10·71 by 4½, or 10·34 by 5, with..... 42·87 cwt. uniformly loaded, or 26·79 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The breaking weight of Red Pine 14 feet long, 11·13 in. by 4 in. is 6·61 × 42·87 = 283·3 cwt. uniformly loaded, or 5·288 × 26·79 = 141·6 cwt. suspended from the middle.



TABLE XII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 343 lbs. or 3·0625 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 13720 = 122\cdot50 = 6\cdot125$$

$$\text{Weight suspended from the middle,} \frac{W}{D} = 8575 = 76\cdot56 = 3\cdot828$$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	6	7	8	9	10	11	12			
	DEPTH IN INCHES.									
1	·69	·66	·63	·61	·59	·57	·55	3·06	1·91	$\frac{1}{40}$
2	1·39	1·32	1·26	1·21	1·17	1·14	1·10	6·12	3·82	$\frac{2}{40}$
3	2·08	1·98	1·89	1·82	1·76	1·70	1·65	9·18	5·74	$\frac{3}{40}$
4	2·78	2·64	2·53	2·43	2·34	2·27	2·21	12·25	7·65	$\frac{4}{40}$
5	3·47	3·30	3·16	3·03	2·93	2·84	2·76	15·31	9·57	$\frac{5}{40}$
6	4·17	3·96	3·79	3·64	3·52	3·41	3·31	18·37	11·48	$\frac{6}{40}$
7	4·86	4·62	4·42	4·25	4·10	3·97	3·86	21·43	13·39	$\frac{7}{40}$
8	5·56	5·28	5·05	4·86	4·69	4·54	4·41	24·50	15·31	$\frac{8}{40}$
9	6·25	5·94	5·68	5·46	5·27	5·11	4·96	27·56	17·22	$\frac{9}{40}$
10	6·95	6·60	6·31	6·07	5·86	5·68	5·52	30·62	19·14	$\frac{10}{40}$
11	7·64	7·26	6·94	6·68	6·45	6·25	6·07	33·68	21·05	$\frac{11}{40}$
12	8·34	7·92	7·58	7·28	7·03	6·81	6·62	36·75	22·96	$\frac{12}{40}$
13	9·03	8·58	8·21	7·89	7·62	7·38	7·17	39·81	24·88	$\frac{13}{40}$
*14	9·73	9·24	8·84	8·50	8·20	7·95	7·72	42·87	26·79	$\frac{14}{40}$
15	10·42	9·90	9·47	9·10	8·79	8·52	8·27	45·93	28·71	$\frac{15}{40}$
16	11·12	10·56	10·10	9·71	9·38	9·08	8·82	49·00	30·62	$\frac{16}{40}$
17	11·81	11·22	10·73	10·32	9·96	9·65	9·38	52·06	32·53	$\frac{17}{40}$
18	12·51	11·88	11·36	10·92	10·55	10·22	9·93	55·12	34·45	$\frac{18}{40}$
19	13·20	12·54	12·00	11·53	11·13	10·79	10·48	58·18	36·36	$\frac{19}{40}$
20	13·90	13·20	12·63	12·14	11·72	11·36	11·03	61·25	38·28	$\frac{20}{40}$
21	14·59	13·86	13·26	12·75	12·31	11·92	11·58	64·31	40·19	$\frac{21}{40}$
22	15·29	14·52	13·89	13·35	12·89	12·49	12·13	67·37	42·10	$\frac{22}{40}$
23	15·98	15·18	14·52	13·96	13·48	13·06	12·68	70·43	44·02	$\frac{23}{40}$
24	...	15·84	15·15	14·57	14·07	13·63	13·24	73·50	45·93	$\frac{24}{40}$
25	...	...	15·78	15·17	14·65	14·20	13·79	76·56	47·85	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·567	7·965	8·329	8·662	8·972	9·263	9·535	Uniformly loaded.
6·054	6·372	6·663	6·929	7·177	7·410	7·628	Suspended from the middle

\* *Example.*—Red Pine 14 feet long, 9·73 in. by 6 in., or 9·24 by 7, or 8·84 by 8, or 8·50 by 9, or 8·20 by 10, or 7·95 by 11, or 7·72 by 12, with 42·87 cwt. uniformly loaded, or 26·79 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The breaking weight of Red Pine 14 ft. long, 8·84 in. by 8 in., is  $8\cdot329 \times 42\cdot87 = 357$  cwt. uniformly loaded, or  $6\cdot663 \times 26\cdot79 = 178\cdot5$  cwt. suspended from the middle.

## TABLE XIII.—RED PINE.

WEIGHT upon each foot in length, 421·875 lbs. or 3·7667 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

$$\text{Weight uniformly loaded,.....} \frac{W}{D} = 16875 = 150\cdot67 = 7\cdot533$$

$$\text{Weight suspended from the middle,} \frac{W}{D} = 10546 = 94\cdot16 = 4\cdot708$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	DEPTH IN INCHES.									
1	1·18	1·12	1·07	1·03	1·00	·94	·89	·85	·82	·79
2	2·36	2·25	2·15	2·07	1·99	1·88	1·78	1·70	1·64	1·58
3	3·55	3·37	3·22	3·10	2·99	2·81	2·67	2·56	2·46	2·37
4	4·73	4·49	4·30	4·13	3·99	3·75	3·56	3·41	3·28	3·16
5	5·91	5·61	5·37	5·16	4·98	4·69	4·46	4·26	4·10	3·96
6	7·09	6·74	6·44	6·20	5·98	5·63	5·35	5·11	4·92	4·75
7	8·27	7·86	7·52	7·23	6·98	6·57	6·24	5·97	5·74	5·54
8	9·45	8·98	8·59	8·26	7·97	7·50	7·13	6·82	6·56	6·33
9	10·64	10·10	9·66	9·29	8·97	8·44	8·02	7·67	7·37	7·12
10	11·82	11·23	10·74	10·33	9·97	9·38	8·91	8·52	8·19	7·91
11	13·00	12·35	11·81	11·36	10·96	10·32	9·80	9·37	9·01	8·70
12	14·18	13·47	12·89	12·39	11·96	11·26	10·69	10·23	9·83	9·49
13	...	14·59	13·96	13·42	12·96	12·19	11·58	11·08	10·65	10·29
14	...	...	15·03	14·46	13·95	13·13	12·47	11·93	11·47	11·08
*15	...	...	...	...	14·95	14·07	13·37	12·78	12·29	11·87
16	...	...	...	...	...	15·01	14·26	13·63	13·11	12·66
17	...	...	...	...	...	...	15·15	14·49	13·93	13·45
18	...	...	...	...	...	...	...	15·34	14·75	14·24
19	...	...	...	...	...	...	...	...	15·57	15·03
20	...	...	...	...	...	...	...	...	...	15·82
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·449	4·683	4·897	5·095	5·275	5·606	5·901	6·170	6·417	6·647
3·559	3·747	3·918	4·074	4·220	4·484	4·720	4·936	5·133	5·317

\* *Example*.—Red Pine 15 feet long, ... 14·95 in. by  $2\frac{1}{4}$  in., or 14·07 by 3, or 13·87 by  $3\frac{1}{2}$ , or 12·78 by 4, or 12·29 by  $4\frac{1}{2}$ , or 11·87 by 5, with ..... 56·50 cwt. uniformly loaded, or 35·31 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The breaking weight of Red Pine 15 feet long 12·29 in. by  $4\frac{1}{2}$  in. is  $6·417 \times 56·5 = 362·5$  cwt. uniformly loaded, or  $5·133 \times 35·31 = 181·2$  cwt. suspended from the middle.

TABLE XIII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 421·875 lbs. or 3·7667 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.Weight uniformly loaded, ...  $\frac{W}{D} = 16875 = 150\cdot67 = 7\cdot533$ Weight suspended from the middle,  $\frac{W}{D} = 10546 = 94\cdot16 = 4\cdot708$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	6	7	8	9	10	11	12			
	DEPTH IN INCHES.									
1	·74	·71	·68	·65	·63	·61	·59	3·76	2·35	$\frac{1}{40}$
2	1·49	1·41	1·35	1·30	1·26	1·22	1·18	7·53	4·70	$\frac{2}{40}$
3	2·23	2·12	2·03	1·95	1·88	1·83	1·77	11·30	7·06	$\frac{3}{40}$
4	2·98	2·83	2·71	2·60	2·51	2·43	2·36	15·06	9·41	$\frac{4}{40}$
5	3·72	3·54	3·38	3·25	3·14	3·04	2·95	18·83	11·77	$\frac{5}{40}$
6	4·47	4·24	4·06	3·90	3·77	3·65	3·55	22·60	14·12	$\frac{6}{40}$
7	5·21	4·95	4·73	4·55	4·40	4·26	4·14	26·36	16·47	$\frac{7}{40}$
8	5·96	5·66	5·41	5·20	5·02	4·87	4·73	30·13	18·83	$\frac{8}{40}$
9	6·70	6·36	6·09	5·85	5·65	5·48	5·32	33·90	21·18	$\frac{9}{40}$
10	7·45	7·07	6·76	6·50	6·28	6·08	5·91	37·66	23·54	$\frac{10}{40}$
11	8·19	7·78	7·44	7·15	6·91	6·69	6·50	41·43	25·89	$\frac{11}{40}$
12	8·93	8·49	8·12	7·80	7·53	7·30	7·09	45·20	28·25	$\frac{12}{40}$
13	9·68	9·19	8·79	8·45	8·16	7·91	7·68	48·96	30·60	$\frac{13}{40}$
14	10·42	9·90	9·47	9·10	8·79	8·52	8·27	52·73	32·95	$\frac{14}{40}$
* 15	11·17	10·61	10·15	9·75	9·42	9·13	8·86	56·50	35·31	$\frac{15}{40}$
16	11·91	11·31	10·82	10·40	10·05	9·73	9·45	60·26	37·66	$\frac{16}{40}$
17	12·66	12·02	11·50	11·06	10·67	10·34	10·05	64·03	40·02	$\frac{17}{40}$
18	13·40	12·73	12·18	11·71	11·30	10·95	10·64	67·80	42·37	$\frac{18}{40}$
19	14·15	13·44	12·85	12·36	11·93	11·56	11·23	71·56	44·73	$\frac{19}{40}$
20	14·89	14·14	13·53	13·01	12·56	12·17	11·82	75·33	47·08	$\frac{20}{40}$
21	15·63	14·85	14·20	13·66	13·19	12·78	12·41	79·10	49·43	$\frac{21}{40}$
22	...	15·56	14·88	14·31	13·81	13·38	13·00	82·86	51·79	$\frac{22}{40}$
23	...	...	15·56	14·96	14·44	13·99	13·59	86·63	54·14	$\frac{23}{40}$
24	...	...	...	15·61	15·07	14·60	14·18	90·40	56·50	$\frac{24}{40}$
25	...	...	...	...	15·70	15·21	14·77	94·16	58·85	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·063 7·434 7·774 8·084 8·374 8·645 8·899 | Uniformly loaded.

5·650 5·947 6·219 6·467 6·699 6·916 7·119 | Suspended from the middle.

\* *Example.*—Red Pine 15 feet long, 11·17 in. by 6 in., or 10·61 by 7, or 10·15 by 8, or 9·75 by 9, or 9·42 by 10, or 9·13 by 11, or 8·86 by 12, with 56·50 cwt. uniformly loaded, or 35·31 cwt. suspended from the middle, deflects  $\frac{15}{40}$  of an inch.

The breaking weight of Red Pine 15 feet long, 9·75 in. by 9 in., is  $8\cdot084 \times 56\cdot5 = 456\cdot7$  cwt. uniformly loaded, or  $6\cdot467 \times 35\cdot31 = 228\cdot3$  cwt. suspended from the middle.

## TABLE XIV.—RED PINE.

WEIGHT upon each foot in length, 512 lbs. or 4·5714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

$$\text{Weight uniformly loaded} \dots \dots \dots \frac{W}{D} = 20480 = 182 \cdot 85 = 9 \cdot 142$$

lbs.      cwt.      tons.

$$\text{Weight suspended from the middle, } \frac{W}{D} = 12800 = 114 \cdot 28 = 5 \cdot 714$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	1½	1¾	2	2¼	2½	3	3½	4	4½	5
	DEPTH IN INCHES.									
1	1·26	1·20	1·15	1·10	1·06	1·00	·95	·91	·87	·84
2	2·52	2·39	2·29	2·20	2·13	2·00	1·90	1·82	1·75	1·69
3	3·78	3·59	3·44	3·30	3·19	3·00	2·85	2·73	2·62	2·53
4	5·04	4·79	4·58	4·41	4·25	4·00	3·80	3·64	3·50	3·38
5	6·30	5·99	5·73	5·51	5·32	5·00	4·75	4·54	4·37	4·22
6	7·56	7·18	6·87	6·61	6·38	6·00	5·70	5·45	5·24	5·06
7	8·82	8·38	8·02	7·71	7·44	7·00	6·65	6·36	6·12	5·91
8	10·09	9·58	9·16	8·81	8·51	8·00	7·60	7·27	6·99	6·75
9	11·35	10·78	10·31	9·91	9·57	9·00	8·55	8·18	7·87	7·60
10	12·61	11·97	11·45	11·01	10·63	10·01	9·50	9·09	8·74	8·44
11	13·87	13·17	12·60	12·12	11·70	11·01	10·45	10·00	9·61	9·28
12	15·13	14·37	13·74	13·22	12·76	12·01	11·40	10·91	10·49	10·13
13	...	...	14·89	14·32	13·82	13·01	12·36	11·82	11·36	10·97
14	...	...	...	15·42	14·88	14·01	13·31	12·73	12·24	11·81
15	...	...	...	...	15·95	15·01	14·26	13·63	13·11	12·66
* 16	...	...	...	...	...	...	15·21	14·54	13·98	13·50
17	...	...	...	...	...	...	...	15·45	14·86	14·35
18	...	...	...	...	...	...	...	...	15·73	15·19
19	...	...	...	...	...	...	...	...	...	16·03
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·171	4·391	4·591	4·776	4·945	5·255	5·532	5·784	6·016	6·231
3·337	3·512	3·673	3·821	3·956	4·204	4·425	4·627	4·813	4·985

\* *Example.*—Red Pine, 16 feet long, ..... 15·21 in. by 3½ in., or 14·54 by 4, or 13·98 by 4½, or 13·50 by 5, with ..... 73·14 cwt. uniformly loaded, or 45·71 cwt. suspended from the middle, deflects  $\frac{1}{40}$  of an inch.

The breaking weight of Red Pine 16 feet long, 13·50 in. by 5 in. is 6·231 × 73·14 = 455·7 cwt. uniformly loaded, or 4·985 × 45·71 = 227·8 cwt. suspended from the middle.



TABLE XIV. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 512 lbs. or 4·5714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{40}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 20480 = 182\cdot85 = 9\cdot142$

lbs.      cwt.      ton.

Weight suspended from the middle,  $\frac{W}{D} = 12800 = 114\cdot28 = 5\cdot714$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	6	7	8	9	10	11	12			
	DEPTH IN INCHES.									
1	·79	·75	·72	·69	·67	·65	·63	4·57	2·85	$\frac{1}{40}$
2	1·59	1·51	1·44	1·39	1·34	1·30	1·26	9·14	5·71	$\frac{2}{40}$
3	2·38	2·26	2·16	2·08	2·01	1·95	1·89	13·71	8·57	$\frac{3}{40}$
4	3·18	3·02	2·89	2·77	2·68	2·60	2·52	18·28	11·42	$\frac{4}{40}$
5	3·97	3·77	3·61	3·47	3·35	3·24	3·15	22·85	14·28	$\frac{5}{40}$
6	4·76	4·53	4·33	4·16	4·02	3·89	3·78	27·42	17·14	$\frac{6}{40}$
7	5·56	5·28	5·05	4·86	4·69	4·54	4·41	32·00	20·00	$\frac{7}{40}$
8	6·35	6·03	5·77	5·55	5·36	5·19	5·04	36·57	22·85	$\frac{8}{40}$
9	7·15	6·79	6·49	6·24	6·03	5·84	5·67	41·14	25·71	$\frac{9}{40}$
10	7·94	7·54	7·22	6·94	6·70	6·49	6·30	45·71	28·57	$\frac{10}{40}$
11	8·74	8·30	7·94	7·63	7·37	7·14	6·93	50·28	31·42	$\frac{11}{40}$
12	9·53	9·05	8·66	8·32	8·04	7·79	7·56	54·85	34·28	$\frac{12}{40}$
13	10·32	9·81	9·38	9·02	8·71	8·44	8·19	59·42	37·14	$\frac{13}{40}$
14	11·12	10·56	10·10	9·71	9·38	9·08	8·82	64·00	40·00	$\frac{14}{40}$
15	11·91	11·31	10·82	10·41	10·05	9·73	9·45	68·57	42·85	$\frac{15}{40}$
*16	12·71	12·07	11·54	11·10	10·72	10·38	10·08	73·14	45·71	$\frac{16}{40}$
17	13·50	12·82	12·27	11·79	11·39	11·03	10·72	77·71	48·57	$\frac{17}{40}$
18	14·29	13·58	12·99	12·49	12·06	11·68	11·35	82·28	51·42	$\frac{18}{40}$
19	15·09	14·33	13·71	13·18	12·73	12·33	11·98	86·85	54·28	$\frac{19}{40}$
20	15·88	15·09	14·43	13·87	13·40	12·98	12·61	91·42	57·14	$\frac{20}{40}$
21	...	15·84	15·15	14·57	14·07	13·63	13·24	96·00	60·00	$\frac{21}{40}$
22	...	...	15·87	15·26	14·73	14·28	13·87	100·57	62·85	$\frac{22}{40}$
23	...	...	...	15·95	15·40	14·92	14·50	105·14	65·71	$\frac{23}{40}$
24	...	...	...	...	16·07	15·57	15·13	109·71	68·57	$\frac{24}{40}$
25	...	...	...	...	...	16·22	15·76	114·28	71·42	$\frac{25}{40}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

6·621	6·970	7·288	7·579	7·850	8·105	8·343	Uniformly loaded.
5·297	5·576	5·830	6·063	6·280	6·484	6·674	Suspended from the middle.

\* *Example.*—Red Pine 16 feet long, 12·71 in. by 6 in., or 12·07 by 7, or 11·54 by 8, or 11·10 by 9, or 10·72 by 10, or 10·38 by 11, or 10·08 by 12, with 73·14 cwt. uniformly loaded, or 45·71 cwt. suspended from the middle, deflects  $\frac{16}{40}$  of an inch.

The breaking weight of Red Pine 16 ft. long 10·72 in. by 10 in., is  $7\cdot85 \times 73\cdot14 = 574\cdot1$  cwt. uniformly loaded, or  $6\cdot28 \times 45\cdot71 = 287$  cwt. suspended from the middle.

TABLE XV.—RED PINE.

WEIGHT upon each foot in length, 648 lbs., or 5·7857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{45}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 29160 = 260\cdot35 = 13\cdot017$$

lbs.                      cwt.                      tons.

$$\text{Weight suspended from the middle, } \frac{W}{D} = 18225 = 162\cdot72 = 8\cdot136$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	2½	3	3½	4	4½	5	6	7
	DEPTH IN INCHES.									
1	1·29	1·24	1·20	1·13	1·07	1·02	·98	·95	·89	·85
2	2·58	2·48	2·39	2·25	2·14	2·05	1·97	1·90	1·79	1·70
3	3·87	3·72	3·59	3·38	3·21	3·07	2·95	2·85	2·68	2·55
4	5·15	4·96	4·78	4·50	4·28	4·09	3·93	3·80	3·57	3·39
5	6·44	6·20	5·98	5·63	5·35	5·11	4·92	4·75	4·47	4·24
6	7·73	7·43	7·18	6·75	6·42	6·14	5·90	5·70	5·36	5·09
7	9·02	8·67	8·37	7·88	7·48	7·16	6·88	6·65	6·25	5·94
8	10·31	9·91	9·57	9·00	8·55	8·18	7·87	7·60	7·15	6·79
9	11·60	11·15	10·77	10·13	9·62	9·20	8·85	8·54	8·04	7·64
10	12·89	12·39	11·96	11·26	10·69	10·23	9·83	9·49	8·93	8·49
11	14·17	13·63	13·16	12·38	11·76	11·25	10·82	10·44	9·83	9·33
12	...	14·87	14·35	13·51	12·83	12·27	11·80	11·39	10·72	10·18
13	...	...	...	14·63	13·90	13·29	12·78	12·34	11·61	11·03
14	...	...	...	...	14·97	14·32	13·77	13·29	12·51	11·88
*15	...	...	...	...	...	15·34	14·75	14·24	13·40	12·73
16	...	...	...	...	...	...	15·73	15·19	14·29	13·58
17	...	...	...	...	...	...	...	16·14	15·19	14·43
18	...	...	...	...	...	...	...	...	16·08	15·27
19	...	...	...	...	...	...	...	...	...	16·12
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·776	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970
3·673	3·821	3·956	5·204	4·425	4·627	4·813	4·985	5·297	5·576

\* *Example.*—Red Pine 15 feet long, ..... 15·34 in. by 4 in., or 14·75 by 4½, or 14·24 by 5, or 13·40 by 6, or 12·73 by 7, with ..... 86·73 cwt. uniformly loaded, or 54·24 cwt. suspended from the middle, deflects  $\frac{1}{45}$  of an inch.

The breaking weight of Red Pine 15 ft. long, 13·40 in. by 6 in., is 6·621 × 86·78 = 574·6 cwt. uniformly loaded, or 5·297 × 54·24 = 287·3 cwt. suspended from the middle.

TABLE XV. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 648 lbs., or 5·7857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{45}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 29160 = 260 \cdot 35 = 13 \cdot 017$$

$$\text{Weight suspended from the middle,} \frac{W}{D} = 18225 = 162 \cdot 72 = 8 \cdot 136$$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	8	9	10	11	12	13	14			
	DEPTH IN INCHES.									
1	·81	·78	·75	·73	·71	·69	·67	5·78	3·61	$\frac{1}{45}$
2	1·62	1·56	1·51	1·46	1·42	1·38	1·35	11·57	7·23	$\frac{2}{45}$
3	2·44	2·34	2·26	2·19	2·13	2·07	2·02	17·35	10·84	$\frac{3}{45}$
4	3·25	3·12	3·01	2·92	2·84	2·76	2·69	23·14	14·46	$\frac{4}{45}$
5	4·06	3·90	3·77	3·65	3·55	3·45	3·37	28·92	18·08	$\frac{5}{45}$
6	4·87	4·68	4·52	4·38	4·25	4·14	4·04	34·71	21·69	$\frac{6}{45}$
7	5·68	5·46	5·27	5·11	4·96	4·83	4·72	40·50	25·31	$\frac{7}{45}$
8	6·49	6·24	6·03	5·84	5·67	5·52	5·39	46·28	28·92	$\frac{8}{45}$
9	7·31	7·02	6·78	6·57	6·38	6·21	6·06	52·07	32·54	$\frac{9}{45}$
10	8·12	7·80	7·54	7·30	7·09	6·90	6·74	57·85	36·16	$\frac{10}{45}$
11	8·93	8·58	8·29	8·03	7·80	7·59	7·41	63·64	39·77	$\frac{11}{45}$
12	9·74	9·36	9·04	8·76	8·51	8·28	8·08	69·42	43·39	$\frac{12}{45}$
13	10·55	10·15	9·80	9·49	9·22	8·98	8·76	75·21	47·00	$\frac{13}{45}$
14	11·36	10·93	10·55	10·22	9·93	9·67	9·43	81·00	50·62	$\frac{14}{45}$
* 15	12·18	11·71	11·30	10·95	10·64	10·36	10·10	86·78	54·24	$\frac{15}{45}$
16	12·99	12·49	12·06	11·68	11·35	11·05	10·78	92·57	57·85	$\frac{16}{45}$
17	13·80	13·27	12·81	12·41	12·05	11·74	11·45	98·35	61·47	$\frac{17}{45}$
18	14·61	14·05	13·56	13·14	12·76	12·43	12·12	104·14	65·08	$\frac{18}{45}$
19	15·42	14·83	14·32	13·87	13·47	13·12	12·80	109·92	68·70	$\frac{19}{45}$
20	16·23	15·61	15·07	14·60	14·18	13·81	13·47	115·71	72·32	$\frac{20}{45}$
21	...	16·39	15·82	15·33	14·89	14·50	14·15	121·50	75·93	$\frac{21}{45}$
22	...	...	16·58	16·06	15·60	15·19	14·82	127·28	79·55	$\frac{22}{45}$
23	...	...	...	16·79	16·31	15·88	15·49	133·07	83·16	$\frac{23}{45}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·288	7·579	7·850	8·105	8·343	8·568	8·783	Uniformly loaded.
5·830	6·063	6·280	6·484	6·674	6·854	7·026	Suspended from the middle.

\* *Example.*—Red Pine 15 feet long, 12·18 in. by 8 in., or 11·71 by 9, or 11·30 by 10, or 10·95 by 11, or 10·64 by 12, or 10·36 by 13, or 10·10 by 14, with 86·78 cwt. uniformly loaded, or 54·24 cwt. suspended from the middle, deflects  $\frac{1}{45}$  of an inch.

The breaking weight of Red Pine 15 ft. long, 10·95 in. by 11 in., is 8·105 × 86·78 = 703·3 cwt. uniformly loaded, or 6·484 × 54·24 = 351·6 cwt. suspended from the middle.

TABLE XVI.—RED PINE.

WEIGHT upon each foot in length, 800 lbs. or 7.1428 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{30}$  of an inch.
$$\text{Weight uniformly loaded} \dots \dots \dots \frac{W}{D} = \frac{\text{lbs.}}{40000} = \frac{\text{cwt.}}{357.14} = \frac{\text{tons}}{17.857}$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 25000 = 223.21 = 11.160$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	1.43	1.33	1.25	1.19	1.14	1.09	1.05	.99	.94	.90
2	2.86	2.66	2.50	2.38	2.27	2.19	2.11	1.99	1.89	1.80
3	4.30	3.99	3.75	3.56	3.41	3.28	3.16	2.98	2.83	2.71
4	5.73	5.32	5.00	4.75	4.55	4.37	4.22	3.97	3.77	3.61
5	7.16	6.65	6.25	5.94	5.68	5.46	5.27	4.96	4.71	4.51
6	8.59	7.97	7.50	7.13	6.82	6.56	6.33	5.96	5.66	5.41
7	10.02	9.30	8.75	8.32	7.95	7.65	7.38	6.95	6.60	6.31
8	11.45	10.63	10.01	9.50	9.09	8.74	8.44	7.94	7.54	7.22
9	12.89	11.96	11.26	10.69	10.23	9.83	9.49	8.93	8.49	8.12
10	14.32	13.29	12.51	11.88	11.36	10.93	10.55	9.93	9.43	9.02
11	...	14.62	13.76	13.07	12.50	12.02	11.60	10.92	10.37	9.92
12	...	...	15.01	14.26	13.64	13.11	12.66	11.91	11.31	10.82
13	...	...	...	15.45	14.77	14.20	13.71	12.90	12.26	11.72
*14	...	...	...	...	15.91	15.30	14.77	13.90	13.20	12.63
15	...	...	...	...	...	...	15.82	14.89	14.14	13.53
16	...	...	...	...	...	...	...	15.88	15.09	14.43
17	...	...	...	...	...	...	...	...	16.03	15.33
18	...	...	...	...	...	...	...	...	...	16.23
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4.591	4.945	5.255	5.532	5.784	6.016	6.231	6.621	6.970	7.288
3.673	3.956	4.204	4.425	4.627	4.813	4.985	5.297	5.576	5.830

\* *Example.*—Red Pine 14 feet long, . . . 15.91 in. by 4 in., or 15.30 by 4½, or 14.77 by 5, or 13.90 by 6, or 13.20 by 7, or 12.63 by 8, with . . . . . 100 cwt. uniformly loaded, or 62.50 cwt. suspended from the middle, deflects  $\frac{1}{30}$  of an inch.

The breaking weight of Red Pine 14 feet long, 13.20 in. by 7 in., is  $6.97 \times 100 = 697$  cwt. uniformly loaded, or  $5.576 \times 62.5 = 348.5$  cwt. suspended from the middle.



TABLE XVI. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 800 lbs. or 7·1428 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{30}$  of an inch.Weight uniformly loaded.....  $\frac{W}{D} = 40000 = 357\cdot14 = 17\cdot857$ Weight suspended from the middle,  $\frac{W}{D} = 25000 = 223\cdot21 = 11\cdot160$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	·87	·84	·81	·79	·77	·75	·73	7·14	4·46	$\frac{1}{30}$
2	1·73	1·67	1·62	1·58	1·53	1·50	1·46	14·28	8·92	$\frac{2}{30}$
3	2·60	2·51	2·43	2·36	2·30	2·25	2·19	21·42	13·39	$\frac{3}{30}$
4	3·47	3·35	3·24	3·15	3·07	2·99	2·93	28·57	17·85	$\frac{4}{30}$
5	4·34	4·19	4·06	3·94	3·84	3·74	3·66	35·71	22·32	$\frac{5}{30}$
6	5·20	5·02	4·87	4·73	4·60	4·49	4·39	42·85	26·78	$\frac{6}{30}$
7	6·07	5·86	5·68	5·52	5·37	5·24	5·12	50·00	31·25	$\frac{7}{30}$
8	6·94	6·70	6·49	6·30	6·14	5·99	5·85	57·14	35·71	$\frac{8}{30}$
9	7·80	7·54	7·30	7·09	6·90	6·74	6·58	64·28	40·17	$\frac{9}{30}$
10	8·67	8·37	8·11	7·88	7·67	7·48	7·31	71·42	44·64	$\frac{10}{30}$
11	9·54	9·21	8·92	8·67	8·44	8·23	8·05	78·57	49·10	$\frac{11}{30}$
12	10·41	10·05	9·73	9·45	9·21	8·98	8·78	85·71	53·57	$\frac{12}{30}$
13	11·27	10·88	10·54	10·24	9·97	9·73	9·51	92·85	58·03	$\frac{13}{30}$
* 14	12·14	11·72	11·36	11·03	10·74	10·48	10·24	100·00	62·50	$\frac{14}{30}$
15	13·01	12·56	12·17	11·82	11·51	11·23	10·97	107·14	66·96	$\frac{15}{30}$
16	13·87	13·40	12·98	12·61	12·27	11·98	11·70	114·28	71·42	$\frac{16}{30}$
17	14·74	14·23	13·79	13·39	13·04	12·72	12·43	121·42	75·89	$\frac{17}{30}$
18	15·61	15·07	14·60	14·18	13·81	13·47	13·17	128·57	80·35	$\frac{18}{30}$
19	16·48	15·91	15·41	14·97	14·58	14·22	13·90	135·71	84·82	$\frac{19}{30}$
20	...	16·74	16·22	15·76	15·34	14·97	14·63	142·85	89·28	$\frac{20}{30}$
21	...	...	...	16·55	16·11	15·72	15·36	150·00	93·75	$\frac{21}{30}$
22	...	...	...	...	16·88	16·47	16·09	157·14	98·21	$\frac{22}{30}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 14 feet long, 12·14 in. by 9 in., or 11·72 by 10, or 11·36 by 11, or 11·03 by 12, or 10·74 by 13, or 10·48 by 14, or 10·24 by 15, with 100 cwt. uniformly loaded, or 62·50 cwt. suspended from the middle, deflects  $\frac{14}{30}$  of an inch.

The breaking weight of Red Pine 17 ft. long, 13·04 in. by 13 in., is 8·568 × 121·42 = 1040·3 cwt. uniformly loaded, or 6·854 × 75·89 = 520·1 cwt. suspended from the middle.

## TABLE XVII.—RED PINE.

WEIGHT upon each foot in length, 968 lbs. or 8·6428 cwts.

DEFLECTION in the middle for each foot in length,  $\frac{1}{3}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 53240 = 475\cdot35 = 23\cdot767$

lbs.      cwts.      tons.

Weight suspended from the middle,  $\frac{W}{D} = 33275 = 297\cdot09 = 14\cdot854$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	1·57	1·46	1·38	1·31	1·25	1·20	1·16	1·09	1·04	·99
2	3·15	2·92	2·75	2·61	2·50	2·40	2·32	2·18	2·07	1·98
3	4·72	4·39	4·13	3·92	3·75	3·61	3·48	3·28	3·11	2·98
4	6·30	5·85	5·50	5·23	5·00	4·81	4·64	4·37	4·15	3·97
5	7·87	7·31	6·88	6·53	6·25	6·01	5·80	5·46	5·19	4·96
6	9·45	8·77	8·25	7·84	7·50	7·21	6·96	6·55	6·22	5·95
7	11·02	10·23	9·63	9·15	8·75	8·41	8·12	7·64	7·26	6·94
8	12·60	11·70	11·01	10·46	10·00	9·61	9·28	8·74	8·30	7·94
9	14·17	13·16	12·38	11·76	11·25	10·82	10·44	9·83	9·33	8·93
10	...	14·62	13·76	13·07	12·50	12·02	11·60	10·92	10·37	9·92
11	...	...	15·13	14·38	13·75	13·22	12·76	12·01	11·41	10·91
12	...	...	...	15·68	15·00	14·42	13·92	13·10	12·45	11·90
* 13	...	...	...	...	...	15·62	15·08	14·20	13·48	12·90
14	...	...	...	...	...	...	...	15·29	14·52	13·89
15	...	...	...	...	...	...	...	...	15·56	14·88
16	...	...	...	...	...	...	...	...	...	15·87
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example.*—Red Pine 13 feet long, .... 15·62 in. by 4½ in., or 15·08 by 5, or 14·20 by 6, or 13·48 by 7, or 12·90 by 8, with ..... 112·35 cwts. uniformly loaded, or 70·22 cwts. suspended from the middle, deflects  $\frac{1}{3}$  of an inch.

The breaking weight of Red Pine 13 feet long, 12·90 in. by 8 in., is 7·288 × 112·35 = 818·8 cwts. uniformly loaded, or 5·83 × 70·22 = 409·4 cwts. suspended from the middle.

TABLE XVII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 968 lbs. or 8·6428 cwts.

DEFLECTION in the middle for each foot in length,  $\frac{1}{5}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 53240 = 475\cdot35 = 23\cdot767$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 33275 = 297\cdot09 = 14\cdot854$$

Length in feet, clear bearing	BREADTH IN INCHES.							Weight uniformly loaded, in cwts.	Weight suspended from the middle, in cwts.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	·95	·92	·89	·87	·84	·82	·80	8·64	5·40	$\frac{1}{55}$
2	1·91	1·84	1·78	1·73	1·69	1·65	1·61	17·28	10·80	$\frac{2}{55}$
3	2·86	2·76	2·68	2·60	2·53	2·47	2·41	25·92	16·20	$\frac{3}{55}$
4	3·82	3·68	3·57	3·47	3·38	3·29	3·22	34·57	21·60	$\frac{4}{55}$
5	4·77	4·60	4·46	4·33	4·22	4·12	4·02	43·21	27·00	$\frac{5}{55}$
6	5·72	5·53	5·35	5·20	5·06	4·94	4·83	51·85	32·41	$\frac{6}{55}$
7	6·68	6·45	6·25	6·07	5·91	5·76	5·63	60·50	37·81	$\frac{7}{55}$
8	7·63	7·37	7·14	6·93	6·75	6·59	6·44	69·14	43·21	$\frac{8}{55}$
9	8·58	8·29	8·03	7·80	7·59	7·41	7·24	77·78	48·61	$\frac{9}{55}$
10	9·54	9·21	8·92	8·67	8·44	8·23	8·05	86·42	54·01	$\frac{10}{55}$
11	10·49	10·13	9·81	9·53	9·28	9·06	8·85	95·07	59·41	$\frac{11}{55}$
12	11·45	11·05	10·71	10·40	10·13	9·88	9·65	103·71	64·82	$\frac{12}{55}$
*13	12·40	11·97	11·60	11·27	10·97	10·70	10·46	112·35	70·22	$\frac{13}{55}$
14	13·35	12·89	12·49	12·13	11·81	11·53	11·26	121·00	75·62	$\frac{14}{55}$
15	14·31	13·81	13·38	13·00	12·66	12·35	12·07	129·64	81·02	$\frac{15}{55}$
16	15·26	14·74	14·28	13·87	13·50	13·17	12·87	138·28	86·42	$\frac{16}{55}$
17	16·22	15·66	15·17	14·73	14·35	14·00	13·68	146·92	91·83	$\frac{17}{55}$
18	...	16·58	16·06	15·60	15·19	14·82	14·48	155·57	97·23	$\frac{18}{55}$
19	...	...	...	16·47	16·03	15·64	15·29	164·21	102·63	$\frac{19}{55}$
20	...	...	...	...	16·88	16·47	16·09	172·85	108·03	$\frac{20}{55}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 13 feet long, 12·40 in. by 9 in., or 11·97 by 10, or 11·60 by 11, or 11·27 by 12, or 10·97 by 13, or 10·70 by 14, or 10·46 by 15, with 112·35 cwts. uniformly loaded, or 70·22 cwts. suspended from the middle, deflects  $\frac{13}{55}$  of an inch.

The breaking weight of Red Pine 17 feet long, 14 in. by 14 in., is  $8\cdot783 \times 146\cdot92 = 1290\cdot4$  cwts. uniformly loaded, or  $7\cdot026 \times 91\cdot83 = 645\cdot2$  cwts. suspended from the middle.

## TABLE XVIII.—RED PINE.

WEIGHT upon each foot in length, 1152 lbs. or 10·2857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{6}$  of an inch.

$$\text{Weight uniformly loaded, } \dots\dots\dots \frac{W}{D} = \frac{\text{lbs.}}{69120} = \frac{\text{cwt.}}{617\cdot14} = \frac{\text{tons.}}{30\cdot857}$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 43200 = 385\cdot71 = 19\cdot285$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	1·72	1·59	1·50	1·43	1·36	1·31	1·27	1·19	1·13	1·08
2	3·44	3·19	3·00	2·85	2·73	2·62	2·53	2·38	2·26	2·16
3	5·15	4·78	4·50	4·28	4·09	3·93	3·80	3·57	3·39	3·25
4	6·87	6·38	6·00	5·70	5·45	5·24	5·06	4·76	4·53	4·33
5	8·59	7·97	7·50	7·13	6·82	6·56	6·33	5·96	5·66	5·41
6	10·31	9·57	9·00	8·55	8·18	7·87	7·60	7·15	6·79	6·49
7	12·03	11·16	10·51	9·98	9·55	9·18	8·86	8·34	7·92	7·58
8	13·74	12·76	12·01	11·41	10·91	10·49	10·13	9·53	9·05	8·66
9	15·46	14·35	13·51	12·83	12·27	11·80	11·39	10·72	10·18	9·74
10	...	...	15·01	14·26	13·64	13·11	12·66	11·91	11·32	10·82
11	...	...	...	15·68	15·00	14·42	13·92	13·10	12·45	11·90
* 12	...	...	...	...	...	15·73	15·19	14·29	13·58	12·99
13	...	...	...	...	...	...	...	15·49	14·71	14·07
14	...	...	...	...	...	...	...	...	15·84	15·15
15	...	...	...	...	...	...	...	...	...	16·23
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example.*—Red Pine 12 ft. long, ..... 15·73 in. by 4½ in., or 15·19 by 5, or 14·29 by 6, or 13·58 by 7, or 12·99 by 8, with ..... 123·42 cwt. uniformly loaded, or 77·14 cwt. suspended from the middle, deflects  $\frac{1}{6}$  of an inch.

The breaking weight of Red Pine 12 ft. long, 13·58 in. by 7 in. is 6·97 × 123·42 = 860·2 cwt. uniformly loaded, or 5·576 × 77·14 = 430·1 cwt. suspended from the middle.



TABLE XVIII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 1152 lbs. or 10·2857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{60}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{69120} = \frac{\text{cwt.}}{617\cdot14} = \frac{\text{tons.}}{30\cdot857}$

Weight suspended from the middle,  $\frac{W}{D} = 43200 = 385\cdot71 = 19\cdot285$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·04	1·00	·97	·95	·92	·90	·88	10·28	6·42	$\frac{1}{60}$
2	2·08	2·01	1·95	1·89	1·84	1·80	1·76	20·57	12·85	$\frac{2}{60}$
3	3·12	3·01	2·92	2·84	2·76	2·69	2·63	30·85	19·28	$\frac{3}{60}$
4	4·16	4·02	3·89	3·78	3·68	3·59	3·51	41·14	25·71	$\frac{4}{60}$
5	5·20	5·02	4·87	4·73	4·60	4·49	4·39	51·42	32·14	$\frac{5}{60}$
6	6·24	6·03	5·84	5·67	5·52	5·39	5·27	61·71	38·57	$\frac{6}{60}$
7	7·28	7·03	6·81	6·62	6·44	6·29	6·14	72·00	45·00	$\frac{7}{60}$
8	8·32	8·04	7·79	7·56	7·36	7·18	7·02	82·28	51·42	$\frac{8}{60}$
9	9·37	9·04	8·76	8·51	8·28	8·08	7·90	92·57	57·85	$\frac{9}{60}$
10	10·41	10·05	9·73	9·45	9·21	8·98	8·78	102·85	64·28	$\frac{10}{60}$
11	11·45	11·05	10·71	10·40	10·13	9·88	9·65	113·14	70·71	$\frac{11}{60}$
* 12	12·49	12·06	11·68	11·35	11·05	10·78	10·53	123·42	77·14	$\frac{12}{60}$
13	13·53	13·06	12·65	12·29	11·97	11·68	11·41	133·71	83·57	$\frac{13}{60}$
14	14·57	14·07	13·63	13·24	12·89	12·57	12·29	144·00	90·00	$\frac{14}{60}$
15	15·61	15·07	14·60	14·18	13·81	13·47	13·17	154·28	96·42	$\frac{15}{60}$
16	16·65	16·08	15·57	15·13	14·73	14·37	14·04	164·57	102·85	$\frac{16}{60}$
17	...	...	16·55	16·07	15·65	15·27	14·92	174·85	109·28	$\frac{17}{60}$
18	...	...	...	...	16·57	16·17	15·80	185·14	115·71	$\frac{18}{60}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 12 feet long, 12·49 in. by 9 in., or 12·06 by 10, or 11·68 by 11, or 11·35 by 12, or 11·05 by 13, or 10·78 by 14, or 10·53 by 15, with 123·42 cwt. uniformly loaded, or 77·14 cwt. suspended from the middle, deflects  $\frac{12}{60}$  of an inch.

The breaking weight of Red Pine 12 feet long, 12·06 in. by 10 in., is  $7·85 \times 123·42 = 968·8$  cwt., uniformly loaded, or  $6·28 \times 77·14 = 484·4$  cwt. suspended from the middle.

## TABLE XIX.—RED PINE.

WEIGHT upon each foot in length, 1352 lbs. or 12·0714 cwts.

DEFLECTION in the middle for each foot in length,  $\frac{1}{65}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 87880 = 784\cdot64 = 39\cdot232$

Weight suspended from the middle,  $\frac{W}{D} = 54925 = 490\cdot40 = 24\cdot520$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	1·86	1·73	1·63	1·54	1·48	1·42	1·37	1·29	1·23	1·17
2	3·72	3·46	3·25	3·09	2·95	2·84	2·74	2·58	2·45	2·34
3	5·58	5·18	4·88	4·63	4·43	4·26	4·11	3·87	3·68	3·52
4	7·44	6·91	6·50	6·18	5·91	5·68	5·49	5·16	4·90	4·69
5	9·31	8·64	8·13	7·72	7·39	7·10	6·86	6·45	6·13	5·86
6	11·17	10·37	9·76	9·27	8·86	8·52	8·23	7·74	7·35	7·03
7	13·03	12·09	11·38	10·81	10·34	9·94	9·60	9·03	8·58	8·21
8	14·89	13·82	13·01	12·36	11·82	11·36	10·97	10·32	9·81	9·38
9	...	...	14·63	13·90	13·29	12·78	12·34	11·61	11·03	10·55
10	...	...	...	15·45	14·77	14·20	13·71	12·90	12·26	11·72
*11	...	...	...	...	16·25	15·62	15·08	14·20	13·48	12·90
12	...	...	...	...	...	...	16·46	15·49	14·71	14·07
13	...	...	...	...	...	...	...	...	15·94	15·24
14	...	...	...	...	...	...	...	...	...	16·41
15	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 11 feet long, .... 16·25 in. by 4 in., or 15·62 by 4½, or 15·08 by 5, or 14·20 by 6, or 13·48 by 7, or 12·90 by 8, with ..... 132·78 cwts. uniformly loaded, or 82·99 cwts. suspended from the middle, deflects  $\frac{1}{65}$  of an inch.

The breaking weight of Red Pine 11 ft. long, 14·20 in. by 6 in., is 6·621 × 132·78 = 879·1 cwts. uniformly loaded, or 5·297 × 82·99 = 439·5 cwts. suspended from the middle.

TABLE XIX. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 1352 lbs. or 12·0714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{65}$  of an inch.Weight uniformly loaded .....  $\frac{W}{D} = 87880 \frac{\text{lbs.}}{\text{D}} = 784\cdot64 \frac{\text{cwt.}}{\text{D}} = 39\cdot232 \frac{\text{tons.}}{\text{D}}$ Weight suspended from the middle,  $\frac{W}{D} = 54925 = 490\cdot40 = 24\cdot520$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·13	1·09	1·05	1·02	1·00	·97	·95	12·07	7·54	$\frac{1}{65}$
2	2·25	2·18	2·11	2·05	1·99	1·95	1·90	24·14	15·08	$\frac{2}{65}$
3	3·38	3·27	3·16	3·07	2·99	2·92	2·85	36·21	22·63	$\frac{3}{65}$
4	4·51	4·35	4·22	4·10	3·99	3·89	3·80	48·28	30·17	$\frac{4}{65}$
5	5·64	5·44	5·27	5·12	4·99	4·86	4·75	60·35	37·72	$\frac{5}{65}$
6	6·76	6·53	6·33	6·15	5·98	5·84	5·71	72·42	45·26	$\frac{6}{65}$
7	7·89	7·62	7·38	7·17	6·98	6·81	6·66	84·50	52·81	$\frac{7}{65}$
8	9·02	8·71	8·44	8·19	7·98	7·78	7·61	96·57	60·35	$\frac{8}{65}$
9	10·15	9·80	9·49	9·22	8·98	8·76	8·56	108·64	67·90	$\frac{9}{65}$
10	11·27	10·88	10·54	10·24	9·97	9·73	9·51	120·71	75·44	$\frac{10}{65}$
*11	12·40	11·97	11·60	11·27	10·97	10·70	10·46	132·78	82·99	$\frac{11}{65}$
12	13·53	13·06	12·65	12·29	11·97	11·68	11·41	144·85	90·53	$\frac{12}{65}$
13	14·66	14·15	13·71	13·32	12·96	12·65	12·36	156·92	98·08	$\frac{13}{65}$
14	15·78	15·24	14·76	14·34	13·96	13·62	13·31	169·00	105·62	$\frac{14}{65}$
15	16·91	16·33	15·82	15·36	14·96	14·59	14·26	181·07	113·16	$\frac{15}{65}$
16	...	...	16·87	16·39	15·96	15·57	15·21	193·14	120·71	$\frac{16}{65}$
17	...	...	...	...	16·95	16·54	16·16	205·21	128·25	$\frac{17}{65}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 11 feet long, 12·40 in. by 9 in., or 11·97 by 10, or 11·60 by 11, or 11·27 by 12, or 10·97 by 13, or 10·70 by 14, or 10·46 by 15, with 132·78 cwt. uniformly loaded, or 82·99 cwt. suspended from the middle, deflects  $\frac{11}{65}$  of an inch.

The breaking weight of Red Pine 12 feet long, 13·06 in. by 10 in., is  $7·85 \times 144·85 = 1137$  cwt. uniformly loaded, or  $6·28 \times 90·53 = 568·5$  cwt. suspended from the middle.

TABLE XX.—RED PINE.

WEIGHT upon each foot in length, 1568 lbs. or 14 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{10}$  of an inch.

Weight uniformly loaded, .....  $\frac{W}{D} = 109760 = 980 \cdot 00 = 49 \cdot 000$

Weight suspended from the middle,  $\frac{W}{D} = 68600 = 612 \cdot 50 = 30 \cdot 625$

Length in feet, clear bearing	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·00	1·86	1·75	1·66	1·59	1·53	1·48	1·39	1·32	1·26
2	4·01	3·72	3·50	3·33	3·18	3·06	2·95	2·78	2·64	2·53
3	6·01	5·58	5·25	4·99	4·77	4·59	4·43	4·17	3·96	3·79
4	8·02	7·44	7·00	6·65	6·36	6·12	5·91	5·56	5·28	5·05
5	10·02	9·30	8·75	8·32	7·95	7·65	7·38	6·95	6·60	6·31
6	12·03	11·16	10·51	9·98	9·55	9·18	8·86	8·34	7·92	7·58
7	14·03	13·02	12·26	11·64	11·14	10·71	10·34	9·73	9·24	8·84
8	...	14·89	14·01	13·31	12·73	12·24	11·81	11·12	10·56	10·10
9	...	...	15·76	14·97	14·32	13·77	13·29	12·51	11·88	11·36
*10	...	...	...	...	15·91	15·30	14·77	13·90	13·20	12·63
11	...	...	...	...	...	...	16·25	15·29	14·52	13·89
12	...	...	...	...	...	...	...	16·68	15·84	15·15
13	...	...	...	...	...	...	...	...	...	16·41
14	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 10 feet long, .... 15·91 in. by 4 in., or 15·30 by 4½, or 14·77 by 5, or 13·90 by 6, or 13·20 by 7, or 12·63 by 8, with ..... 140 cwt. uniformly loaded, or 87·50 cwt. suspended from the middle, deflects  $\frac{1}{10}$  of an inch.

The breaking weight of Red Pine 10 feet long 14·77 in. by 5 in. is  $6·231 \times 140 = 872·3$  cwt. uniformly loaded, or  $4·985 \times 87·5 = 436·1$  cwt. suspended from the middle.



TABLE XX. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 1568 lbs. or 14 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{70}$  of an inch.Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{109760} = \frac{\text{cwt.}}{980.00} = \frac{\text{tons.}}{49.000}$ Weight suspended from the middle,  $\frac{W}{D} = \frac{68600}{612.50} = 30.625$ 

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1.21	1.17	1.14	1.10	1.07	1.05	1.02	14.00	8.75	$\frac{1}{70}$
2	2.43	2.34	2.27	2.21	2.15	2.10	2.05	28.00	17.50	$\frac{2}{70}$
3	3.64	3.52	3.41	3.31	3.22	3.14	3.07	42.00	26.25	$\frac{3}{70}$
4	4.86	4.69	4.54	4.41	4.30	4.19	4.10	56.00	35.00	$\frac{4}{70}$
5	6.07	5.86	5.68	5.52	5.37	5.24	5.12	70.00	43.75	$\frac{5}{70}$
6	7.28	7.03	6.81	6.62	6.44	6.29	6.14	84.00	52.50	$\frac{6}{70}$
7	8.50	8.21	7.95	7.72	7.52	7.33	7.17	98.00	61.25	$\frac{7}{70}$
8	9.71	9.38	9.08	8.82	8.59	8.38	8.19	112.00	70.00	$\frac{8}{70}$
9	10.93	10.55	10.22	9.93	9.67	9.43	9.22	126.00	78.75	$\frac{9}{70}$
* 10	12.14	11.72	11.36	11.03	10.74	10.48	10.24	140.00	87.50	$\frac{10}{70}$
11	13.35	12.89	12.49	12.13	11.81	11.53	11.26	154.00	96.25	$\frac{11}{70}$
12	14.57	14.07	13.63	13.24	12.89	12.57	12.29	168.00	105.00	$\frac{12}{70}$
13	15.78	15.24	14.76	14.34	13.96	13.62	13.31	182.00	113.75	$\frac{13}{70}$
14	...	16.41	15.90	15.44	15.04	14.67	14.34	196.00	122.50	$\frac{14}{70}$
15	...	...	...	16.55	16.11	15.72	15.36	210.00	131.25	$\frac{15}{70}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7.579	7.850	8.105	8.343	8.568	8.783	8.988	Uniformly loaded.
6.063	6.280	6.484	6.674	6.854	7.026	7.190	Suspended from the middle

\* *Example.*—Red Pine 10 feet long, 12.14 in. by 9 in., or 11.72 by 10, or 11.36 by 11, or 11.03 by 12, or 10.74 by 13, or 10.48 by 14, or 10.24 by 15, with 140 cwt. uniformly loaded, or 87.50 cwt. suspended from the middle, deflects  $\frac{10}{70}$  of an inch.

The breaking weight of Red Pine 14 feet long, 15.04 in. by 13 in., is  $8.568 \times 196 = 1679.3$  cwt. uniformly loaded, or  $6.854 \times 122.5 = 839.6$  cwt. suspended from the middle.

TABLE XXI.—RED PINE.

WEIGHT upon each foot in length, 1800 lbs. or 16·0714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{75}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 135000 = 1205\cdot35 = 60\cdot267$

Weight suspended from the middle,  $\frac{W}{D} = 84375 = 753\cdot34 = 37\cdot667$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·15	1·99	1·88	1·78	1·70	1·64	1·58	1·49	1·41	1·35
2	4·30	3·99	3·75	3·56	3·41	3·28	3·16	2·98	2·83	2·71
3	6·44	5·98	5·63	5·35	5·11	4·92	4·75	4·47	4·24	4·06
4	8·59	7·98	7·50	7·13	6·82	6·56	6·33	5·96	5·66	5·41
5	10·74	9·97	9·38	8·91	8·52	8·19	7·91	7·45	7·07	6·76
6	12·89	11·96	11·26	10·69	10·23	9·83	9·49	8·93	8·49	8·12
7	15·03	13·96	13·13	12·47	11·93	11·47	11·08	10·42	9·90	9·47
8	...	...	15·01	14·26	13·64	13·11	12·66	11·91	11·32	10·82
*9	...	...	...	...	15·34	14·75	14·24	13·40	12·73	12·18
10	...	...	...	...	...	...	15·82	14·89	14·14	13·53
11	...	...	...	...	...	...	...	...	15·56	14·88
12	...	...	...	...	...	...	...	...	...	16·23
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 9 feet long, .... 15·34 in. by 4 in., or 14·75 by 4½, or 14·24 by 5, or 13·40 by 6, or 12·73 by 7, or 12·18 by 8, with ..... 144·64 cwt. uniformly loaded, or 90·40 cwt. suspended from the middle, deflects  $\frac{2}{75}$  of an inch.

The breaking weight of Red Pine 9 feet long, 14·75 in. by 4½ in., is  $6·016 \times 144·64 = 870·1$  cwt. uniformly loaded, or  $4·813 \times 90·4 = 435·0$  cwt. suspended from the middle.

TABLE XXI. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 1800 lbs., or 16·0714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{75}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{\text{D}} = 135000 = 1205\cdot35 = 60\cdot267$

Weight suspended from the middle,  $\frac{W}{D} = 84375 = 753\cdot34 = 37\cdot667$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·30	1·26	1·22	1·18	1·15	1·12	1·10	16·07	10·04	$\frac{1}{75}$
2	2·60	2·51	2·43	2·36	2·30	2·25	2·19	32·14	20·08	$\frac{2}{75}$
3	3·90	3·77	3·65	3·55	3·45	3·37	3·29	48·21	30·13	$\frac{3}{75}$
4	5·20	5·02	4·87	4·73	4·60	4·49	4·39	64·28	40·17	$\frac{4}{75}$
5	6·50	6·28	6·08	5·91	5·75	5·61	5·49	80·35	50·22	$\frac{5}{75}$
6	7·80	7·54	7·30	7·09	6·90	6·74	6·58	96·42	60·26	$\frac{6}{75}$
7	9·11	8·79	8·52	8·27	8·06	7·86	7·68	112·50	70·31	$\frac{7}{75}$
8	10·41	10·05	9·73	9·45	9·21	8·98	8·78	128·57	80·35	$\frac{8}{75}$
*9	11·71	11·30	10·95	10·64	10·36	10·10	9·87	144·64	90·40	$\frac{9}{75}$
10	13·01	12·56	12·17	11·82	11·51	11·23	10·97	160·71	100·44	$\frac{10}{75}$
11	14·31	13·81	13·38	13·00	12·66	12·35	12·07	176·78	110·49	$\frac{11}{75}$
12	15·61	15·07	14·60	14·18	13·81	13·47	13·17	192·85	120·53	$\frac{12}{75}$
13	...	16·33	15·82	15·36	14·96	14·59	14·26	208·92	130·57	$\frac{13}{75}$
14	...	...	...	16·55	16·11	15·72	15·36	225·00	140·62	$\frac{14}{75}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 9 feet long, 11·71 in. by 9 in., or 11·30 by 10, or 10·95 by 11, or 10·64 by 12, or 10·36 by 13, or 10·10 by 14, or 9·87 by 15, with 144·64 cwt. uniformly loaded, or 90·40 cwt. suspended from the middle, deflects  $\frac{9}{75}$  of an inch.

The breaking weight of Red Pine 11 ft. long, 13·00 in. by 12 in., is  $8\cdot343 \times 176\cdot78 = 1474\cdot8$  cwt. uniformly loaded, or  $6\cdot674 \times 110\cdot49 = 737\cdot4$  cwt. suspended from the middle.

TABLE XXII.—RED PINE.

WEIGHT upon each foot in length, 2048 lbs., or 18·2857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{80}$  of an inch.

$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 163840 = 1462\cdot85 = 73\cdot142$$

lbs.                      cwt.                      tons.

$$\text{Weight suspended from the middle, } \frac{W}{D} = 102400 = 914\cdot28 = 45\cdot714$$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·29	2·13	2·00	1·90	1·82	1·75	1·69	1·59	1·51	1·44
2	4·58	4·25	4·00	3·80	3·64	3·50	3·38	3·18	3·02	2·89
3	6·87	6·38	6·00	5·70	5·45	5·24	5·06	4·76	4·53	4·33
4	9·16	8·51	8·00	7·60	7·27	6·99	6·75	6·35	6·03	5·77
5	11·45	10·63	10·01	9·50	9·09	8·74	8·44	7·94	7·54	7·22
6	13·74	12·76	12·01	11·41	10·91	10·49	10·13	9·53	9·05	8·66
7	...	14·89	14·01	13·31	12·73	12·24	11·81	11·12	10·56	10·10
*8	...	...	16·01	15·21	14·54	13·99	13·50	12·71	12·07	11·54
9	...	...	...	...	16·36	15·73	15·19	14·29	13·58	12·99
10	...	...	...	...	...	...	16·88	15·88	15·09	14·43
11	...	...	...	...	...	...	...	...	16·60	15·87
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 8 feet long, .. 16·01 in. by 3 in., or 15·21 by 3½, or 14·54 by 4, or 13·99 by 4½, or 13·50 by 5, or 12·71 by 6, or 12·07 by 7, or 11·54 by 8, with ..... 146·28 cwt. uniformly loaded, or 91·42 cwt. suspended from the middle, deflects  $\frac{8}{80}$  of an inch.

The breaking weight of Red Pine 8 ft. long, 14·54 in. by 4 in., is  $5·784 \times 146·28 = 846$  cwt. uniformly loaded, or  $4·627 \times 91·42 = 423$  cwt. suspended from the middle.



TABLE XXII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 2048 lbs. or 18·2857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{80}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 163840 = 1462\cdot85 = 73\cdot142$

Weight suspended from the middle,  $\frac{W}{D} = 102400 = 914\cdot28 = 45\cdot714$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·39	1·34	1·30	1·26	1·23	1·20	1·17	18·28	11·42	$\frac{1}{80}$
2	2·78	2·68	2·60	2·52	2·45	2·39	2·34	36·57	22·85	$\frac{2}{80}$
3	4·16	4·02	3·89	3·78	3·68	3·59	3·51	54·85	34·28	$\frac{3}{80}$
4	5·55	5·36	5·19	5·04	4·91	4·79	4·68	73·14	45·71	$\frac{4}{80}$
5	6·94	6·70	6·49	6·30	6·14	5·99	5·85	91·42	57·14	$\frac{5}{80}$
6	8·33	8·04	7·79	7·56	7·36	7·18	7·02	109·71	68·57	$\frac{6}{80}$
7	9·71	9·38	9·08	8·82	8·59	8·38	8·19	128·00	80·00	$\frac{7}{80}$
*8	11·10	10·72	10·38	10·09	9·82	9·58	9·36	146·28	91·42	$\frac{8}{80}$
9	12·49	12·06	11·68	11·35	11·05	10·78	10·53	164·57	102·85	$\frac{9}{80}$
10	13·88	13·40	12·98	12·61	12·27	11·97	11·70	182·85	114·28	$\frac{10}{80}$
11	15·26	14·74	14·27	13·87	13·50	13·17	12·87	201·14	125·71	$\frac{11}{80}$
12	16·65	16·08	15·57	15·13	14·73	14·37	14·04	219·42	137·14	$\frac{12}{80}$
13	...	...	16·87	16·39	15·96	15·57	15·21	237·71	148·57	$\frac{13}{80}$
14	...	...	...	...	...	16·76	16·38	256·00	160·00	$\frac{14}{80}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 8 feet long, 11·10 in. by 9 in., or 10·72 by 10, or 10·38 by 11, or 10·09 by 12, or 9·82 by 13, or 9·58 by 14, or 9·36 by 15, with 146·28 cwt. uniformly loaded, or 91·42 cwt. suspended from the middle, deflects  $\frac{8}{80}$  of an inch.

The breaking weight of Red Pine 10 ft. long, 12·98 in. by 11 in., is  $8\cdot105 \times 182\cdot85 = 1482$  cwt. uniformly loaded, or  $6\cdot484 \times 114\cdot28 = 741$  cwt. suspended from the middle.

TABLE XXIII.—RED PINE.

WEIGHT upon each foot in length, 2312 lbs. or 20·6428 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{85}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 196520 = 1754\cdot64 = 87\cdot732$

Weight suspended from the middle,  $\frac{W}{D} = 122825 = 1096\cdot65 = 54\cdot832$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·43	2·26	2·13	2·02	1·93	1·86	1·79	1·69	1·60	1·53
2	4·87	4·52	4·25	4·04	3·86	3·71	3·59	3·38	3·21	3·07
3	7·30	6·78	6·38	6·06	5·80	5·57	5·38	5·06	4·81	4·60
4	9·74	9·04	8·50	8·08	7·73	7·43	7·17	6·75	6·41	6·13
5	12·17	11·30	10·63	10·10	9·66	9·29	8·97	8·44	8·02	7·67
6	14·60	13·56	12·76	12·12	11·59	11·14	10·76	10·13	9·62	9·20
*7	...	15·82	14·88	14·14	13·52	13·00	12·55	11·81	11·22	10·73
8	...	...	...	...	15·45	14·86	14·35	13·50	12·82	12·27
9	...	...	...	...	...	...	16·14	15·19	14·43	13·80
10	...	...	...	...	...	...	...	...	16·03	15·33
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 7 feet long, . 15·82 in. by 2½ in., or 14·88 by 3, or 14·14 by 3½, or 13·52 by 4, or 13·00 by 4½, or 12·55 by 5, or 11·81 by 6, or 11·22 by 7, or 10·73 by 8, with ..... 144·50 cwt. uniformly loaded, or 90·31 cwt. suspended from the middle, deflects  $\frac{7}{85}$  of an inch.

The breaking weight of Red Pine 7 feet long, 14·14 in. by 3½ in., is  $5·532 \times 144·5 = 799·3$  cwt. uniformly loaded, or  $4·425 \times 90·31 = 399·6$  cwt. suspended from the middle.

TABLE XXIII. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 2312 lbs. or 20·6428 cwt.s.

DEFLECTION in the middle for each foot in length,  $\frac{1}{85}$  of an inch.

Weight uniformly loaded,.....  $\frac{W}{D} = 196520 = 1754\cdot64 = 87\cdot732$

$\frac{W}{D}$       lbs.      cwt.s.      tons.

Weight suspended from the middle,  $\frac{W}{D} = 122825 = 1096\cdot65 = 54\cdot832$

$\frac{W}{D}$       lbs.      cwt.s.      tons.

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·47	1·42	1·38	1·34	1·30	1·27	1·24	20·64	12·90	$\frac{1}{85}$
2	2·95	2·85	2·76	2·68	2·61	2·54	2·49	41·28	25·80	$\frac{2}{85}$
3	4·42	4·27	4·14	4·02	3·91	3·82	3·73	61·92	38·70	$\frac{3}{85}$
4	5·90	5·69	5·52	5·36	5·22	5·09	4·97	82·57	51·60	$\frac{4}{85}$
5	7·37	7·12	6·89	6·70	6·52	6·36	6·22	103·21	64·50	$\frac{5}{85}$
6	8·85	8·54	8·27	8·04	7·82	7·63	7·46	123·85	77·41	$\frac{6}{85}$
*7	10·32	9·96	9·65	9·38	9·13	8·91	8·70	144·50	90·31	$\frac{7}{85}$
8	11·79	11·39	11·03	10·72	10·43	10·18	9·95	165·14	103·21	$\frac{8}{85}$
9	13·27	12·81	12·41	12·05	11·74	11·45	11·19	185·78	116·11	$\frac{9}{85}$
10	14·74	14·23	13·79	13·39	13·04	12·72	12·43	206·42	129·01	$\frac{10}{85}$
11	16·22	15·66	15·17	14·73	14·35	14·00	13·68	227·07	141·92	$\frac{11}{85}$
12	...	...	16·55	16·07	15·65	15·27	14·92	247·71	154·82	$\frac{12}{85}$
13	...	...	...	...	16·95	16·54	16·16	268·35	167·72	$\frac{13}{85}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 7 feet long, 10·32 in. by 9 in., or 9·96 by 10, or 9·65 by 11, or 9·38 by 12, or 9·13 by 13, or 8·91 by 14, or 8·70 by 15, with 144·50 cwt.s. uniformly loaded, or 90·31 cwt.s. suspended from the middle, deflects  $\frac{7}{85}$  of an inch.

The breaking weight of Red Pine 9 feet long, 12·05 in. by 12 in., is  $8\cdot343 \times 185\cdot78 = 1549\cdot9$  cwt.s. uniformly loaded, or  $6\cdot674 \times 116\cdot11 = 774\cdot9$  cwt.s. suspended from the middle.

TABLE XXIV.—RED PINE.

WEIGHT upon each foot in length, 2592 lbs. or 23·1428 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{8}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = 233280 = 2082\cdot85 = 104\cdot142$

Weight suspended from the middle,  $\frac{W}{D} = 145800 = 1301\cdot78 = 65\cdot089$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·58	2·39	2·25	2·14	2·05	1·97	1·90	1·79	1·70	1·62
2	5·15	4·78	4·50	4·28	4·09	3·93	3·80	3·57	3·39	3·25
3	7·73	7·18	6·75	6·42	6·14	5·90	5·70	5·36	5·09	4·87
4	10·31	9·57	9·00	8·55	8·18	7·87	7·60	7·15	6·79	6·49
5	12·89	11·96	11·26	10·69	10·23	9·83	9·49	8·93	8·49	8·12
*6	15·46	14·35	13·51	12·83	12·27	11·80	11·39	10·72	10·18	9·74
7	...	...	15·76	14·97	14·32	13·77	13·29	12·51	11·88	11·36
8	...	...	...	...	...	15·73	15·19	14·29	13·58	12·99
9	...	...	...	...	...	...	...	16·08	15·28	14·61
10	...	...	...	...	...	...	...	...	...	16·23
11	...	...	...	...	...	...	...	...	...	...
12	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine 6 feet long, 15·46 in. by 2 in., or 14·35 by 2½, or 13·51 by 3, or 12·83 by 3½, or 12·27 by 4, or 11·80 by 4½, or 11·39 by 5, or 10·72 by 6, or 10·18 by 7, or 9·74 by 8, with ..... 138·85 cwt. uniformly loaded, or 86·78 cwt. suspended from the middle, deflects  $\frac{6}{8}$  of an inch.

The breaking weight of Red Pine 6 feet long, 13·51 in. by 3 in., is  $5·255 \times 138·85 = 729·6$  cwt. uniformly loaded, or  $4·204 \times 86·78 = 364·8$  cwt. suspended from the middle.



TABLE XXIV. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 2592 lbs. or 23·1428 cwts.

DEFLECTION in the middle for each foot in length,  $\frac{1}{90}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{\text{D}} = 233280 = 2082\cdot85 = 104\cdot142$

Weight suspended from the middle,  $\frac{W}{D} = 145800 = 1301\cdot78 = 65\cdot089$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwts.	Weight suspended from the middle, in cwts.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·56	1·51	1·46	1·42	1·38	1·35	1·32	23·14	14·46	$\frac{1}{90}$
2	3·12	3·01	2·92	2·84	2·76	2·69	2·63	46·28	28·92	$\frac{2}{90}$
3	4·68	4·52	4·38	4·25	4·14	4·04	3·95	69·42	43·39	$\frac{3}{90}$
4	6·24	6·03	5·84	5·67	5·52	5·39	5·27	92·57	57·85	$\frac{4}{90}$
5	7·80	7·54	7·30	7·09	6·90	6·74	6·58	115·71	72·32	$\frac{5}{90}$
*6	9·37	9·04	8·76	8·51	8·29	8·08	7·90	138·85	86·78	$\frac{6}{90}$
7	10·93	10·55	10·22	9·93	9·67	9·43	9·22	162·00	101·25	$\frac{7}{90}$
8	12·49	12·06	11·68	11·35	11·05	10·78	10·53	185·14	115·71	$\frac{8}{90}$
9	14·05	13·56	13·14	12·76	12·43	12·12	11·85	208·28	130·17	$\frac{9}{90}$
10	15·61	15·07	14·60	14·18	13·81	13·47	13·17	231·42	144·64	$\frac{10}{90}$
11	...	...	16·06	15·60	15·19	14·82	14·48	254·57	159·10	$\frac{11}{90}$
12	...	...	...	...	16·57	16·17	15·80	277·71	173·57	$\frac{12}{90}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 6 feet long, 9·37 in. by 9 in., or 9·04 by 10, or 8·76 by 11, or 8·51 by 12, or 8·29 by 13, or 8·08 by 14, or 7·90 by 15, with 138·85 cwts. uniformly loaded, or 86·78 cwts. suspended from the middle, deflects  $\frac{6}{90}$  of an inch.

The breaking weight of Red Pine 6 feet long, 8·08 in. by 14 in., is  $8·783 \times 138·85 = 1219·5$  cwts. uniformly loaded, or  $7·026 \times 86·78 = 609·7$  cwts. suspended from the middle.

TABLE XXV.—RED PINE.

WEIGHT upon each foot in length, 2888 lbs. or 25·7857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{95}$  of an inch.

Weight uniformly loaded.....  $\frac{W}{D} = \frac{\text{lbs.}}{274360} = \frac{\text{cwt.}}{2449\cdot64} = \frac{\text{tons.}}{122\cdot482}$

Weight suspended from the middle,  $\frac{W}{D} = 171475 = 1531\cdot02 = 76\cdot551$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·72	2·53	2·38	2·26	2·16	2·08	2·00	1·89	1·79	1·71
2	5·44	5·05	4·75	4·51	4·32	4·15	4·01	3·77	3·58	3·43
3	8·16	7·58	7·13	6·77	6·48	6·23	6·01	5·66	5·37	5·14
4	10·88	10·10	9·51	9·03	8·64	8·30	8·02	7·54	7·17	6·85
*5	13·60	12·63	11·88	11·29	10·80	10·38	10·02	9·43	8·96	8·57
6	...	...	14·26	13·54	12·95	12·46	12·03	11·32	10·75	10·28
7	...	...	...	15·80	15·11	14·53	14·03	13·20	12·54	12·00
8	...	...	...	...	...	...	16·03	15·09	14·33	13·71
9	...	...	...	...	...	...	...	...	16·12	15·42
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example*.—Red Pine, 5 feet long, 13·60 in. by 2 in., or 12·63 by 2½, or 11·88 by 3, or 11·29 by 3½, or 10·80 by 4, or 10·38 by 4½, or 10·02 by 5, or 9·43 by 6, or 8·96 by 7, or 8·57 by 8, with ..... 128·92 cwt. uniformly loaded, or 80·58 cwt. suspended from the middle, deflects  $\frac{5}{95}$  of an inch.

The breaking weight of Red Pine 5 feet long, 12·63 in. by 2½ in., is  $4·945 \times 128·92 = 637·5$  cwt. uniformly loaded, or  $3·956 \times 80·58 = 318·7$  cwt. suspended from the middle.

TABLE XXV. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 2888 lbs. or 25·7857 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{95}$  of an inch.
$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 274360 = 2449 \cdot 64 = 122 \cdot 482$$

$$\text{Weight suspended from the middle.} \frac{W}{D} = 171475 = 1531 \cdot 02 = 76 \cdot 551$$

Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·65	1·59	1·54	1·50	1·46	1·42	1·39	25·78	16·11	$\frac{1}{95}$
2	3·30	3·18	3·08	2·98	2·92	2·84	2·78	51·57	32·23	$\frac{2}{95}$
3	4·94	4·77	4·62	4·48	4·37	4·27	4·17	77·35	48·34	$\frac{3}{95}$
4	6·59	6·36	6·16	5·98	5·83	5·69	5·56	103·14	64·46	$\frac{4}{95}$
*5	8·24	7·95	7·71	7·48	7·29	7·11	6·95	128·92	80·58	$\frac{5}{95}$
6	9·89	9·54	9·25	8·97	8·75	8·53	8·34	154·71	96·69	$\frac{6}{95}$
7	11·53	11·14	10·79	10·47	10·20	9·95	9·73	180·50	112·81	$\frac{7}{95}$
8	13·18	12·73	12·33	11·97	11·66	11·38	11·12	206·28	128·92	$\frac{8}{95}$
9	14·83	14·32	13·87	13·46	13·12	12·80	12·51	232·07	145·04	$\frac{9}{95}$
10	16·48	15·91	15·41	14·96	14·58	14·22	13·90	257·85	161·16	$\frac{10}{95}$
11	...	...	...	16·46	16·03	15·64	15·29	283·64	177·27	$\frac{11}{95}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 5 feet long, 8·24 in. by 9 in., or 7·95 by 10, or 7·71 by 11, or 7·48 by 12, or 7·29 by 13, or 7·11 by 14, or 6·95 by 15, with 128·92 cwt. uniformly loaded, or 80·58 cwt. suspended from the middle, deflects  $\frac{5}{95}$  of an inch.

The breaking weight of Red Pine 5 feet long, 7·95 in. by 10 in., is  $7·85 \times 128·92 = 1012$  cwt. uniformly loaded, or  $6·23 \times 80·58 = 506$  cwt. suspended from the middle.

TABLE XXVI.—RED PINE.

WEIGHT upon each foot in length, 3200 lbs. or 28·5714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{100}$  of an inch.

Weight uniformly loaded .....  $\frac{W}{D} = \frac{\text{lbs.}}{320000} = \frac{\text{cwt.}}{2857\cdot14} = \frac{\text{tons.}}{142\cdot857}$

Weight suspended from the middle,  $\frac{W}{D} = \frac{200000}{1785\cdot71} = 89\cdot285$

Length in feet, clear bearing.	BREADTH IN INCHES.									
	2	2½	3	3½	4	4½	5	6	7	8
	DEPTH IN INCHES.									
1	2·86	2·66	2·50	2·38	2·27	2·19	2·11	1·99	1·89	1·80
2	5·73	5·32	5·00	4·75	4·55	4·37	4·22	3·97	3·77	3·61
3	8·59	7·97	7·50	7·13	6·82	6·56	6·33	5·96	5·66	5·41
*4	11·45	10·63	10·01	9·50	9·09	8·74	8·44	7·94	7·54	7·22
5	14·32	13·29	12·51	11·88	11·36	10·93	10·55	9·93	9·43	9·02
6	...	15·95	15·01	14·26	13·64	13·11	12·66	11·91	11·32	10·82
7	...	...	...	...	15·91	15·30	14·77	13·90	13·20	12·63
8	...	...	...	...	...	...	...	15·88	15·09	14·43
9	...	...	...	...	...	...	...	...	...	16·23
10	...	...	...	...	...	...	...	...	...	...
11	...	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

4·591	4·945	5·255	5·532	5·784	6·016	6·231	6·621	6·970	7·288
3·673	3·956	4·204	4·425	4·627	4·813	4·985	5·297	5·576	5·830

\* *Example.*—Red Pine 4 feet long, 11·45 in. by 2 in., or 10·63 by 2½, or 10·01 by 3, or 9·50 by 3½, or 9·09 by 4, or 8·74 by 4½, or 8·44 by 5, or 7·94 by 6, or 7·54 by 7, or 7·22 by 8, with ..... 114·28 cwt. uniformly loaded, or 71·42 cwt. suspended from the middle, deflects  $\frac{4}{100}$  of an inch.

The breaking weight of Red Pine 4 feet long, 11·45 in. by 2 in., is 4·591 × 114·28 = 524·6 cwt. uniformly loaded, or 3·673 × 71·42 = 262·3 cwt. suspended from the middle.



TABLE XXVI. *Continued.*—RED PINE.

WEIGHT upon each foot in length, 3200 lbs. or 28·5714 cwt.

DEFLECTION in the middle for each foot in length,  $\frac{1}{100}$  of an inch.
$$\text{Weight uniformly loaded} \dots\dots\dots \frac{W}{D} = 320000 = 2857 \cdot 14 = 142 \cdot 857$$

$$\text{Weight suspended from the middle, } \frac{W}{D} = 200000 = 1785 \cdot 71 = 89 \cdot 285$$

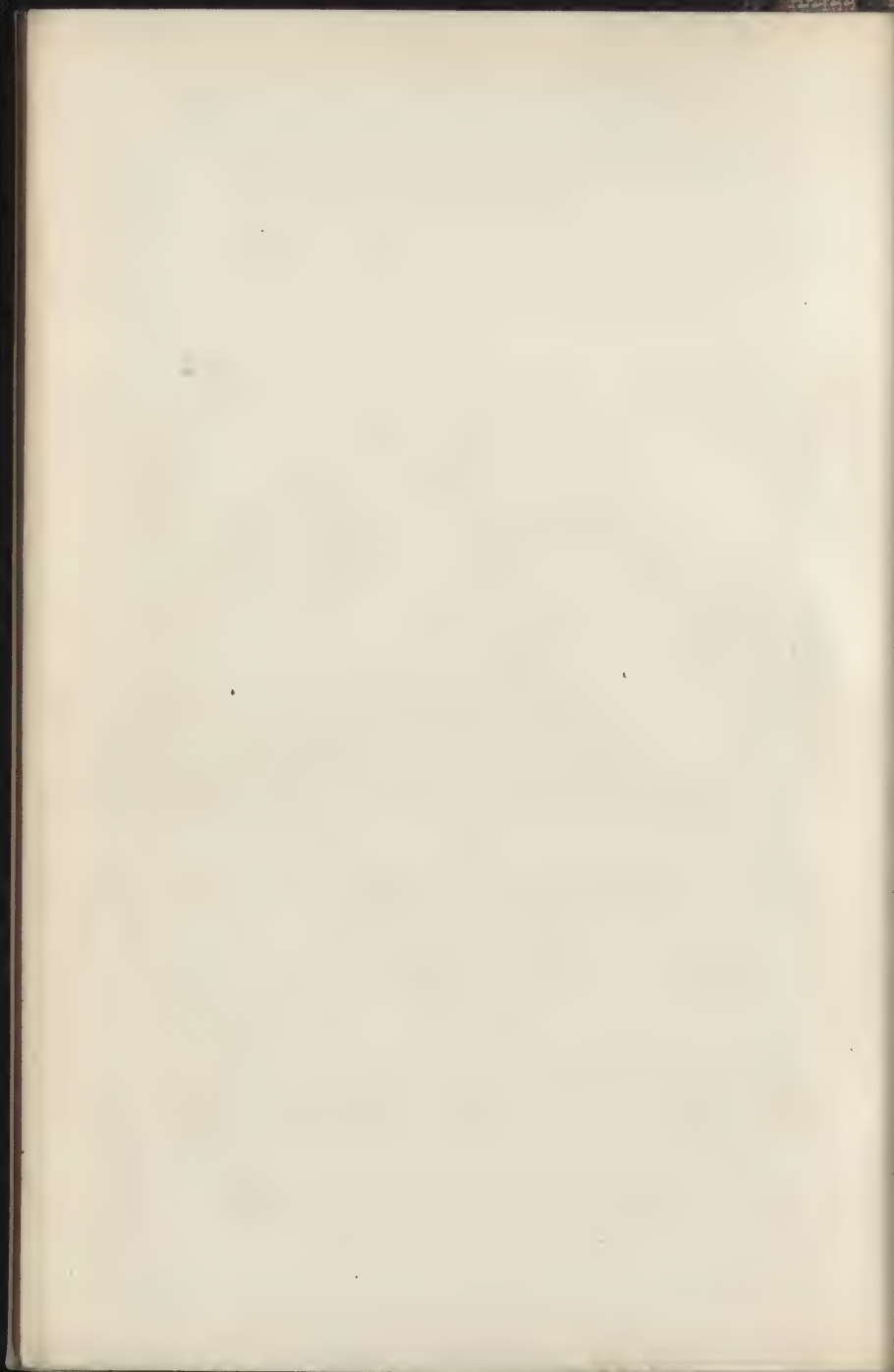
Length in feet, clear bearing.	BREADTH IN INCHES.							Weight uniformly loaded, in cwt.	Weight suspended from the middle, in cwt.	Deflection in the middle, in parts of an inch.
	9	10	11	12	13	14	15			
	DEPTH IN INCHES.									
1	1·73	1·67	1·62	1·58	1·53	1·50	1·46	28·57	17·85	$\frac{1}{100}$
2	3·47	3·35	3·24	3·15	3·07	2·99	2·93	57·14	35·71	$\frac{2}{100}$
3	5·20	5·02	4·87	4·73	4·60	4·49	4·39	85·71	53·57	$\frac{3}{100}$
*4	6·94	6·70	6·49	6·30	6·14	5·99	5·85	114·28	71·42	$\frac{4}{100}$
5	8·67	8·37	8·11	7·88	7·67	7·48	7·31	142·85	89·28	$\frac{5}{100}$
6	10·41	10·05	9·73	9·45	9·21	8·98	8·78	171·42	107·14	$\frac{6}{100}$
7	12·14	11·72	11·36	11·03	10·74	10·48	10·24	200·00	125·00	$\frac{7}{100}$
8	13·88	13·40	12·98	12·61	12·27	11·97	11·70	228·57	142·85	$\frac{8}{100}$
9	15·61	15·07	14·60	14·18	13·81	13·47	13·17	257·14	160·71	$\frac{9}{100}$
10	...	16·75	16·22	15·76	15·34	14·97	14·63	285·71	178·57	$\frac{10}{100}$
11	...	...	...	...	16·88	16·47	16·09	314·28	196·42	$\frac{11}{100}$

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·579	7·850	8·105	8·343	8·568	8·783	8·988	Uniformly loaded.
6·063	6·280	6·484	6·674	6·854	7·026	7·190	Suspended from the middle.

\* *Example.*—Red Pine 4 feet long, 6·94 in. by 9 in., or 6·70 by 10, or 6·49 by 11, or 6·30 by 12, or 6·14 by 13, or 5·99 by 14, or 5·85 by 15, with 114·28 cwt. uniformly loaded, or 71·42 cwt. suspended from the middle, deflects  $\frac{4}{100}$  of an inch.

The breaking weight of Red Pine 4 feet long, 6·94 in. by 9 in., is  $7·579 \times 114·28 = 866$  cwt. uniformly loaded, or  $6·063 \times 71·42 = 433$  cwt. suspended from the middle.



SECOND SERIES,

OR

TABLES OF WEIGHTS:

BY WHICH MAY BE FOUND THE SCANTLINGS OF ANY DESCRIPTION OF  
TIMBER SUFFICIENT TO CARRY, WHEN LOADED, ANY GIVEN  
PORTION OF THE BREAKING WEIGHT.

## TABLE OF CONSTANTS. No. 2.

By which, and the Second Series of Tables, may be found the Scantling of the following species of Timber sufficient to carry, when loaded any given portion of the breaking weight.\*

NAME OF THE WOOD.	WEIGHT uniformly loaded.		WEIGHT suspended from the middle.		DEFLECTION.	
	Factors to give the breaking weight of every Scantling in the Second Series.	Reciprocal of the same.	Factors to give the breaking weight of every Scantling in the Second Series.	Reciprocal of the same.	Relative deflection when loaded with the same weight.	Relative deflection when loaded with one $n^{\text{th}}$ part of the breaking weight.
	$c=8\text{ S.}$	$c=\frac{1}{8\text{ S}}$	$c=4\text{ S.}$	$c=\frac{1}{4\text{ S}}$	$c=E.$	$=S \times$
Standard, } Strength, ...1344 }						
Red Pine } Elasticity, 230000 }						
Acacia .....	11·113	·0899	5·556	·1799	1·597	2·218
Ash .....	12·067	·0828	6·033	·1657	1·118	1·687
Beech .....	9·270	·1078	4·635	·2157	1·359	1·572
Birch, American black ...	10·821	·0924	5·410	·1848	1·245	1·682
„ Common .....	11·476	·0871	5·738	·1742	1·118	1·604
Bullet tree .....	15·773	·0633	7·886	·1267	·700	1·380
Cabacally .....	14·988	·0667	7·494	·1334	·996	1·860
Deal, Christiana .....	9·261	·1079	4·630	·2159	1·157	1·340
„ Memel .....	10·303	·0970	5·151	·1941	1·119	1·442
Elm .....	6·041	·1655	3·020	·3310	2·678	2·022
Fir, Mar Forest .....	7·235	·1382	3·617	·2764	2·186	1·977
„ New England .....	6·562	·1523	3·281	·3047	1·232	1·011
„ Riga .....	6·423	·1556	3·211	·3113	1·603	1·283
Green-heart .....	16·291	·0613	8·145	·1227	·692	1·410
Larch .....	5·955	·1678	2·977	·3357	2·009	1·490
Locust tree .....	20·458	·0488	10·229	·0977	·945	2·411
Norway spars .....	8·767	·1140	4·383	·2281	1·262	1·388
Oak, Adriatic .....	8·229	·1215	4·114	·2430	1·894	1·940
„ African (superior quality)	14·857	·0673	7·428	·1346	·798	1·482
„ Canadian .....	10·515	·0951	5·257	·1902	·950	1·240
„ Dantzic .....	8·750	·1142	4·375	·2285	1·577	1·720
„ English ...	8·497	·1176	4·248	·2353	1·585	1·680
Pine, Pitch .....	9·713	·1029	4·856	·2059	1·502	1·820
„ Red, mean strength, 1341·3	7·983	·1252	3·991	·2505	1·000	1·000
Poon .....	13·218	·0756	6·609	·1513	1·089	1·790
Teak .....	14·661	·0682	7·330	·1364	·762	1·390
Tonquin bean .....	21·583	·0463	10·791	·0926	·692	1·860
	Col. I.	II.	III.	IV.	V.	VI.

\* See *Examples*, page xxiv.



TABLE I.

SCANTLINGS,  $1\frac{1}{2}$  IN. AND  $1\frac{3}{4}$  INCHES DEEP.

The Weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		1	2	3	4	5	6	7	8	9	10
Depth.	Breadth.	WEIGHT IN CWTs.									
$1\frac{1}{2} \times 1$		2.25	1.12	.75	.56	.45	.37	.32	.28	.25	.22
$1\frac{1}{2} \times 1\frac{1}{4}$		2.81	1.40	.93	.70	.56	.46	.40	.35	.31	.28
$1\frac{1}{2} \times 1\frac{1}{2}$		3.37	1.68	1.12	.84	.67	.56	.48	.42	.37	.33
$1\frac{1}{2} \times 1\frac{3}{4}$		3.93	1.96	1.31	.98	.78	.65	.56	.49	.43	.39
$1\frac{1}{2} \times 2$		4.50	2.25	1.50	1.12	.90	.75	.64	.56	.50	.45
$1\frac{1}{2} \times 3$		6.75	3.37	2.25	1.68	1.35	1.12	.96	.84	.75	.67
$1\frac{1}{2} \times 4$		9.00	4.50	3.00	2.25	1.80	1.50	1.28	1.12	1.00	.90
$1\frac{1}{2} \times 5$		11.25	5.62	3.75	2.81	2.25	1.87	1.60	1.40	1.25	1.12
$1\frac{1}{2} \times 6$		13.50	6.75	4.50	3.37	2.70	2.25	1.92	1.68	1.50	1.35
$1\frac{1}{2} \times 7$		15.75	7.87	5.25	3.93	3.15	2.62	2.25	1.96	1.75	1.57
$1\frac{1}{2} \times 8$		18.00	9.00	6.00	4.50	3.60	3.00	2.57	2.25	2.00	1.80
$1\frac{1}{2} \times 9$		20.25	10.12	6.75	5.06	4.05	3.37	2.89	2.53	2.25	2.02
$1\frac{1}{2} \times 10$		22.50	11.25	7.50	5.62	4.50	3.75	3.21	2.81	2.50	2.25
$1\frac{1}{2} \times 11$		24.75	12.37	8.25	6.18	4.95	4.12	3.53	3.09	2.75	2.47
$1\frac{1}{2} \times 12$		27.00	13.50	9.00	6.75	5.40	4.50	3.85	3.37	3.00	2.70
Deflection in inches of Red Pine $1\frac{1}{2}$ inches deep, loaded with the weights in this table.											
Weight uniformly loaded		.011	.044	.099	.175	.274	.394	.537	.701	.887	1.096
Wt. suspended from the middle		.017	.070	.158	.280	.438	.631	.859	1.122	1.420	1.753

\* \* For Scantlings  $1\frac{3}{4}$  inches deep, multiply the weights in this table by  $\frac{4}{3} = 1.3611$ , and the deflections by  $\frac{6}{7} = .857.4$

\* Example 1.—Red Pine  $1\frac{1}{2}$  in. by  $1\frac{3}{4}$  in., 7 feet long, with .56 cwt. uniformly loaded, (one-eighth the breaking weight) deflects .537 of an inch; and with .56 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is .859 of an inch.

+ Example 2.—Red Pine  $1\frac{1}{2}$  in. by  $1\frac{3}{4}$  in., 7 feet long, with .56  $\times$  1.36 = .76 cwt. uniformly loaded, (one-eighth the breaking weight) deflects .537  $\times$   $\frac{6}{7}$  = .460 of an inch; and with .76 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is .859  $\times$   $\frac{6}{7}$  = .736 of an inch.

\* \* To find the Scantlings of Red Pine and other kinds of timber, sufficient to carry, when loaded, one-nth part, or any given portion of the breaking weight, see the Table and Examples referred to in the preceding page.

## TABLE II.

### SCANTLINGS, 2 IN. AND $2\frac{1}{2}$ INCHES DEEP.

The Weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same when suspended from the middle.

SIZE OF SCANTLINGS, in. inches.		LENGTH IN FEET, CLEAR BEARING.									
		1	2	3	4	5	6	7	8	9	10
Depth.	Breadth.	WEIGHT IN CWTs.									
2	$\times 1\frac{1}{2}$	6.00	3.00	2.00	1.50	1.20	1.00	.85	.75	.66	.60
2	$\times 1\frac{3}{4}$	7.00	3.50	2.33	1.75	1.40	1.16	1.00	.87	.77	.70
*2	$\times 2$	8.00	4.00	2.66	2.00	1.60	1.33	1.14	1.00	.88	.80
2	$\times 2\frac{1}{4}$	9.00	4.50	3.00	2.25	1.80	1.50	1.28	1.12	1.00	.90
2	$\times 2\frac{1}{2}$	10.00	5.00	3.33	2.50	2.00	1.66	1.42	1.25	1.11	1.00
2	$\times 3$	12.00	6.00	4.00	3.00	2.40	2.00	1.71	1.50	1.33	1.20
2	$\times 4$	16.00	8.00	5.33	4.00	3.20	2.66	2.28	2.00	1.77	1.60
2	$\times 5$	20.00	10.00	6.66	5.00	4.00	3.33	2.85	2.50	2.22	2.00
2	$\times 6$	24.00	12.00	8.00	6.00	4.80	4.00	3.42	3.00	2.66	2.40
2	$\times 7$	28.00	14.00	9.33	7.00	5.60	4.66	4.00	3.50	3.11	2.80
2	$\times 8$	32.00	16.00	10.66	8.00	6.40	5.33	4.57	4.00	3.55	3.20
2	$\times 9$	36.00	18.00	12.00	9.00	7.20	6.00	5.14	4.50	4.00	3.60
2	$\times 10$	40.00	20.00	13.33	10.00	8.00	6.66	5.71	5.00	4.44	4.00
2	$\times 11$	44.00	22.00	14.66	11.00	8.80	7.33	6.28	5.50	4.88	4.40
2	$\times 12$	48.00	24.00	16.00	12.00	9.60	8.00	6.85	6.00	5.33	4.80
Deflection in inches of Red Pine 2 inches deep, loaded with the weights in this table.											
Weight uniformly loaded		.008	.033	.074	.131	.205	.296	.403	.526	.666	.822
Wt. suspended from the middle		.013	.053	.118	.210	.329	.473	.644	.841	1.065	1.312

\* \* \* For Scantlings  $2\frac{1}{2}$  inches deep, multiply the weights in this table by 1.5625, and the deflections by .8.†

\* Example 1.—Red Pine 2 in. by 2 in., 8 feet long, with 1 cwt. uniformly loaded (one eighth the breaking weight) deflects .526 of an inch; and with 1 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is .841 of an inch.

†\* Example 2.—Red Pine  $2\frac{1}{2}$  in. by 2 in., 8 feet long, with  $1 \times 1.5625 = 1.5625$  cwt. uniformly loaded (one-eighth the breaking weight) deflects  $.526 \times .8 = .4208$  of an inch; and with 1.5625 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is  $.841 \times .8 = .6728$  of an inch.

TABLE III.

SCANTLINGS, 3 IN. AND  $3\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		1	2	3	4	5	6	7	8	9	10
Depth.	Breadth.	WEIGHT IN CWTs.									
3	× 2	18·00	9·00	6·00	4·50	3·60	3·00	2·57	2·25	2·00	1·80
* 3	× $2\frac{1}{4}$	20·25	10·12	6·75	5·06	4·05	3·37	2·89	2·53	2·25	2·02
3	× $2\frac{1}{2}$	22·50	11·25	7·50	5·62	4·50	3·75	3·21	2·81	2·50	2·25
3	× $2\frac{3}{4}$	24·75	12·37	8·25	6·18	4·95	4·12	3·53	3·09	2·75	2·47
3	× 3	27·00	13·50	9·00	6·75	5·40	4·50	3·85	3·37	3·00	2·70
3	× $3\frac{1}{2}$	31·50	15·75	10·50	7·87	6·30	5·25	4·50	3·93	3·50	3·15
3	× 4	36·00	18·00	12·00	9·00	7·20	6·00	5·14	4·50	4·00	3·60
3	× 5	45·00	22·50	15·00	11·25	9·00	7·50	6·42	5·62	5·00	4·50
3	× 6	54·00	27·00	18·00	13·50	10·80	9·00	7·71	6·75	6·00	5·40
3	× 7	63·00	31·50	21·00	15·75	12·60	10·50	9·00	7·87	7·00	6·30
3	× 8	72·00	36·00	24·00	18·00	14·40	12·00	10·28	9·00	8·00	7·20
3	× 9	81·00	40·50	27·00	20·25	16·20	13·50	11·57	10·12	9·00	8·10
3	× 10	90·00	45·00	30·00	22·50	18·00	15·00	12·85	11·25	10·00	9·00
3	× 11	99·00	49·50	33·00	24·75	19·80	16·50	14·14	12·37	11·00	9·90
3	× 12	108·00	54·00	36·00	27·00	21·60	18·00	15·42	13·50	12·00	10·80

Deflection in inches of Red Pine 3 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·005	·022	·049	·088	·137	·197	·268	·351	·444	·548
Wt. suspended from the middle	·009	·035	·079	·140	·219	·316	·430	·561	·710	·877

\* \* For Scantlings  $3\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{49}{36}=1·3611$ , and the deflections by  $\frac{9}{7}=.857\frac{1}{7}$ .

\* Example 1.—Red Pine 3 in. by  $2\frac{1}{4}$  in., 3 feet long, with 6·75 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·049 of an inch; and with 6·75 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·079 of an inch.

† \* Example 2.—Red Pine  $3\frac{1}{2}$  in. by  $2\frac{1}{4}$  in., 3 feet long, with  $6·75 \times 1·36 = 9·18$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·049 \times \frac{9}{7} = ·042$  of an inch; and with 9·18 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·079 \times \frac{9}{7} = ·068$  of an inch.

**TABLE IV.**  
**SCANTLINGS, 4 IN. AND  $4\frac{1}{2}$  INCHES DEEP.**

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
 ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		1	2	3	4	5	6	7	8	9	10
Depth.	Breadth.	WEIGHT IN CWTs.									
4	× 2	32·00	16·00	10·66	8·00	6·40	5·33	4·57	4·00	3·55	3·20
4	× $2\frac{1}{4}$	36·00	18·00	12·00	9·00	7·20	6·00	5·14	4·50	4·00	3·60
*4	× $2\frac{1}{2}$	40·00	20·00	13·33	10·00	8·00	6·66	5·71	5·00	4·44	4·00
4	× 3	48·00	24·00	16·00	12·00	9·60	8·00	6·85	6·00	5·33	4·80
4	× $3\frac{1}{2}$	56·00	28·00	18·66	14·00	11·20	9·33	8·00	7·00	6·22	5·60
4	× 4	64·00	32·00	21·33	16·00	12·80	10·66	9·14	8·00	7·11	6·40
4	× $4\frac{1}{2}$	72·00	36·00	24·00	18·00	14·40	12·00	10·28	9·00	8·00	7·20
4	× 5	80·00	40·00	26·66	20·00	16·00	13·33	11·42	10·00	8·88	8·00
4	× 6	96·00	48·00	32·00	24·00	19·20	16·00	13·71	12·00	10·66	9·60
4	× 7	112·00	56·00	37·33	28·00	22·40	18·66	16·00	14·00	12·44	11·20
4	× 8	128·00	64·00	42·66	32·00	25·60	21·33	18·28	16·00	14·22	12·80
4	× 9	144·00	72·00	48·00	36·00	28·80	24·00	20·57	18·00	16·00	14·40
4	× 10	160·00	80·00	53·33	40·00	32·00	26·66	22·85	20·00	17·77	16·00
4	× 11	176·00	88·00	58·66	44·00	35·20	29·33	25·14	22·00	19·55	17·60
4	× 12	192·00	96·00	64·00	48·00	38·40	32·00	27·42	24·00	21·33	19·20

Deflection in inches of Red Pine 4 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·004	·016	·037	·066	·103	·148	·201	·263	·333	·411
Wt. suspended from the middle	·007	·026	·059	·105	·164	·237	·322	·421	·532	·657

\* \* For Scantlings  $4\frac{1}{2}$  inches deep, multiply the weights in this table  
 by  $\frac{9}{8} = 1·2656$ , and the deflections by  $\frac{8}{9} = ·888$ .†

\* *Example 1.*—Red Pine 4 in. by  $2\frac{1}{2}$  in., 4 feet long, with 10 cwts. uniformly loaded, (one-eighth the breaking weight) deflects ·066 of an inch; and with 10 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is ·105 of an inch.

†\* *Example 2.*—Red Pine  $4\frac{1}{2}$  in. by  $2\frac{1}{2}$  in., 4 feet long, with  $10 \times 1·2656 = 12·656$  cwts. uniformly loaded, (one-eighth the breaking weight) deflects  $·066 \times \frac{9}{8} = ·059$  of an inch; and with 12·656 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·105 \times \frac{8}{9} = ·093$  of an inch.



TABLE IV. *Continued.*SCANTLINGS, 4 IN. AND  $4\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		11	12	13	14	15	16	17	18	19	20
Depth.	Breadth.	WEIGHT IN CWTs.									
4	× 2	2·90	2·66	2·46	2·28	2·13	2·00	1·88	1·77	1·68	1·60
4	× $2\frac{1}{4}$	3·27	3·00	2·76	2·57	2·40	2·25	2·11	2·00	1·89	1·80
*4	× $2\frac{1}{2}$	3·63	3·33	3·07	2·85	2·66	2·50	2·35	2·22	2·10	2·00
4	× 3	4·36	4·00	3·69	3·42	3·20	3·00	2·82	2·66	2·52	2·40
4	× $3\frac{1}{2}$	5·09	4·66	4·30	4·00	3·73	3·50	3·29	3·11	2·94	2·80
4	× 4	5·81	5·33	4·92	4·57	4·26	4·00	3·76	3·55	3·36	3·20
4	× $4\frac{1}{2}$	6·54	6·00	5·53	5·14	4·80	4·50	4·23	4·00	3·78	3·60
4	× 5	7·27	6·66	6·15	5·71	5·33	5·00	4·70	4·44	4·21	4·00
4	× 6	8·72	8·00	7·38	6·85	6·40	6·00	5·64	5·33	5·05	4·80
4	× 7	10·18	9·33	8·61	8·00	7·46	7·00	6·58	6·22	5·89	5·60
4	× 8	11·63	10·66	9·84	9·14	8·53	8·00	7·52	7·11	6·73	6·40
4	× 9	13·09	12·00	11·07	10·28	9·60	9·00	8·47	8·00	7·57	7·20
4	× 10	14·54	13·33	12·30	11·42	10·66	10·00	9·41	8·88	8·42	8·00
4	× 11	16·00	14·66	13·53	12·57	11·73	11·00	10·35	9·77	9·26	8·80
4	× 12	17·45	16·00	14·76	13·71	12·80	12·00	11·29	10·66	10·10	9·60

Deflection in inches of Red Pine 4 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·497	·592	·694	·805	·924	1·052	1·187	1·331	1·483	1·644
Wt. suspended from the middle	·795	·947	1·111	1·288	1·479	1·683	1·900	2·130	2·373	2·630

\* \* For Scantlings  $4\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{8}{64} = 1·2656$ , and the deflections by  $\frac{8}{9} = ·888$ .†

\* Example 1.—Red Pine 4 in. by  $2\frac{1}{2}$  in., 11 feet long, with 3·63 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·497 of an inch; and with 3·63 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·795 of an inch.

† Example 2.—Red Pine  $4\frac{1}{2}$  in. by  $2\frac{1}{2}$  in., 11 feet long, with  $3·63 \times 1·2656 = 4·59$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·497 \times \frac{8}{9} = ·442$  of an inch; and with 4·59 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·795 \times \frac{8}{9} = ·707$  of an inch.

**TABLE V.**  
**SCANTLINGS, 5 IN. AND 5½ INCHES DEEP.**

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded ; or  
 ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.								
		1	2	3	4	5	6	7	8	9
Depth.	Breadth.	WEIGHT IN CWTs.								
5 × 2		50·00	25·00	16·66	12·50	10·00	8·33	7·14	6·25	5·55
5 × 2½		56·25	28·12	18·75	14·06	11·25	9·37	8·03	7·03	6·25
5 × 2½		62·50	31·25	20·83	15·62	12·50	10·41	8·92	7·81	6·94
* 5 × 3		75·00	37·50	25·00	18·75	15·00	12·50	10·71	9·37	8·33
5 × 3½		87·50	43·75	29·16	21·87	17·50	14·58	12·50	10·93	9·72
5 × 4		100·00	50·00	33·33	25·00	20·00	16·66	14·28	12·50	11·11
5 × 4½		112·50	56·25	37·50	28·12	22·50	18·75	16·07	14·06	12·50
5 × 5		125·00	62·50	41·66	31·25	25·00	20·83	17·85	15·62	13·88
5 × 5½		137·50	68·75	45·83	34·37	27·50	22·91	19·64	17·18	15·27
5 × 6		150·00	75·00	50·00	37·50	30·00	25·00	21·42	18·75	16·66
5 × 7		175·00	87·50	58·33	43·75	35·00	29·16	25·00	21·87	19·44
5 × 8		200·00	100·00	66·66	50·00	40·00	33·33	28·57	25·00	22·22
5 × 9		225·00	112·50	75·00	56·25	45·00	37·50	32·14	28·12	25·00
5 × 10		250·00	125·00	83·33	62·50	50·00	41·66	35·71	31·25	27·77
5 × 11		275·00	137·50	91·66	68·75	55·00	45·83	39·28	34·37	30·55
5 × 12		300·00	150·00	100·00	75·00	60·00	50·00	42·85	37·50	33·33
5 × 13		325·00	162·50	108·33	81·25	65·00	54·16	46·42	40·62	36·11
5 × 14		350·00	175·00	116·66	87·50	70·00	58·33	50·00	43·75	38·88
5 × 15		375·00	187·50	125·00	93·75	75·00	62·50	53·57	46·87	41·66

Deflection in inches of Red Pine 5 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·003	·013	·030	·053	·082	·118	·161	·210	·266
Wt. suspended from the middle	·005	·021	·047	·084	·131	·189	·258	·337	·426

\*\*\* For Scantlings 5½ inches deep, multiply the weights in this table by 1·21, and the deflections by  $\frac{10}{11} = .909$ .†

\* *Example 1.*—Red Pine 5 in. by 3 in., 5 feet long, with 15 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·082 of an inch; and with 15 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·131 of an inch.

†\* *Example 2.*—Red Pine 5½ in. by 3 in., 5 feet long, with  $15 \times 1·21 = 18·15$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·082 \times \frac{10}{11} = ·075$  of an inch; and with 18·15 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·131 \times \frac{10}{11} = ·119$  of an inch.

TABLE V. *Continued.*SCANTLINGS, 5 IN. AND  $5\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		10	11	12	13	14	15	16	17	18	20
Depth.	Breadth.	WEIGHT IN CWTs.									
5	× 2	5·00	4·54	4·16	3·84	3·57	3·33	3·12	2·94	2·77	2·50
5	× $2\frac{1}{4}$	5·62	5·11	4·68	4·32	4·01	3·75	3·51	3·30	3·12	2·81
5	× $2\frac{1}{2}$	6·25	5·68	5·20	4·80	4·46	4·16	3·90	3·67	3·47	3·12
*5	× 3	7·50	6·81	6·25	5·76	5·35	5·00	4·68	4·41	4·16	3·75
5	× $3\frac{1}{2}$	8·75	7·95	7·29	6·73	6·25	5·83	5·46	5·14	4·86	4·37
5	× 4	10·00	9·09	8·33	7·69	7·14	6·66	6·25	5·88	5·55	5·00
5	× $4\frac{1}{2}$	11·25	10·23	9·37	8·65	8·03	7·50	7·03	6·61	6·25	5·62
5	× 5	12·50	11·36	10·41	9·61	8·92	8·33	7·81	7·35	6·94	6·25
5	× $5\frac{1}{2}$	13·75	12·50	11·45	10·57	9·82	9·16	8·59	8·08	7·63	6·87
5	× 6	15·00	13·63	12·50	11·53	10·71	10·00	9·37	8·82	8·32	7·50
5	× 7	17·50	15·90	14·58	13·46	12·50	11·66	10·93	10·29	9·72	8·75
5	× 8	20·00	18·18	16·66	15·38	14·28	13·33	12·50	11·76	11·11	10·00
5	× 9	22·50	20·45	18·75	17·30	16·07	15·00	14·06	13·23	12·50	11·25
5	× 10	25·00	22·72	20·83	19·23	17·85	16·66	15·62	14·70	13·88	12·50
5	× 11	27·50	25·00	22·91	21·14	19·64	18·33	17·18	16·17	15·27	13·75
5	× 12	30·00	27·27	25·00	23·07	21·42	20·00	18·75	17·64	16·66	15·00
5	× 13	32·50	29·54	27·08	25·00	23·21	21·66	20·31	19·11	18·05	16·25
5	× 14	35·00	31·81	29·16	26·92	25·00	23·33	21·87	20·58	19·44	17·50
5	× 15	37·50	34·09	31·25	28·84	26·78	25·00	23·43	22·05	20·83	18·75

Deflection in inches of Red Pine 5 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·329	·398	·473	·555	·644	·739	·841	·950	1·065	1·315
Wt. suspended from the middle	·526	·636	·757	·889	1·031	1·183	1·346	1·520	1·704	2·104

\*\* For Scantlings  $5\frac{1}{2}$  inches deep, multiply the weights in this table by 1·21, and the deflections by  $\frac{1}{11}$  = ·909.†

\* Example 1.—Red Pine 5 in. by 3 in., 10 feet long, with 7·50 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·329 of an inch; and with 7·50 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·526 of an inch.

† Example 2.—Red Pine  $5\frac{1}{2}$  in. by 3 in., 10 feet long, with  $7·5 \times 1·21 = 9·075$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·329 \times \frac{1}{11} = ·299$  of an inch; and with 9·075 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·526 \times \frac{1}{11} = ·478$  of an inch.



TABLE VI.

SCANTLINGS, 6 IN. AND  $6\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.								
		1	2	3	4	5	6	7	8	9
Depth.	Breadth.	WEIGHT IN CWTs.								
6	× 2	72·00	36·00	24·00	18·00	14·40	12·00	10·28	9·00	8·00
6	× $2\frac{1}{4}$	81·00	40·50	27·00	20·25	16·20	13·50	11·57	10·12	9·00
6	× $2\frac{1}{2}$	90·00	45·00	30·00	22·50	18·00	15·00	12·85	11·25	10·00
6	× 3	108·00	54·00	36·00	27·00	21·60	18·00	15·42	13·50	12·00
* 6	× $3\frac{1}{2}$	126·00	63·00	42·00	31·50	25·20	21·00	18·00	15·75	14·00
6	× 4	144·00	72·00	48·00	36·00	28·80	24·00	20·57	18·00	16·00
6	× $4\frac{1}{2}$	162·00	81·00	54·00	40·50	32·40	27·00	23·14	20·25	18·00
6	× 5	180·00	90·00	60·00	45·00	36·00	30·00	25·71	22·50	20·00
6	× $5\frac{1}{2}$	198·00	99·00	66·00	49·50	39·60	33·00	28·28	24·75	22·00
6	× 6	216·00	108·00	72·00	54·00	43·20	36·00	30·85	27·00	24·00
6	× $6\frac{1}{2}$	234·00	117·00	78·00	58·50	46·80	39·00	33·42	29·25	26·00
6	× 7	252·00	126·00	84·00	63·00	50·40	42·00	36·00	31·50	28·00
6	× 8	288·00	144·00	96·00	72·00	57·60	48·00	41·14	36·00	32·00
6	× 9	324·00	162·00	108·00	81·00	64·80	54·00	46·28	40·50	36·00
6	× 10	360·00	180·00	120·00	90·00	72·00	60·00	51·42	45·00	40·00
6	× 11	396·00	198·00	132·00	99·00	79·20	66·00	56·57	49·50	44·00
6	× 12	432·00	216·00	144·00	108·00	86·40	72·00	61·71	54·00	48·00
6	× 13	468·00	234·00	156·00	117·00	93·60	78·00	66·85	58·50	52·00
6	× 14	504·00	252·00	168·00	126·00	100·80	84·00	72·00	63·00	56·00
6	× 15	540·00	270·00	180·00	135·00	108·00	90·00	77·14	67·50	60·00

Deflection in inches of Red Pine 6 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·003	·011	·025	·044	·068	·099	·134	·175	·222
Wt. suspended from the middle	·004	·018	·039	·070	·110	·158	·215	·280	·355

\* \* For Scantlings  $6\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{1}{1\frac{6}{4}} = 1\cdot1736$ , and the deflections by  $\frac{1}{1\frac{2}{3}} = \cdot923$ .†

\* Example 1.—Red Pine 6 in. by  $3\frac{1}{2}$  in., 6 feet long, with 21 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·099 of an inch; and with 21 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·158 of an inch.

† \* Example 2.—Red Pine  $6\frac{1}{2}$  in. by  $3\frac{1}{2}$  in., 6 feet long, with  $21 \times 1\cdot1736 = 24\cdot64$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $\cdot099 \times \frac{1}{1\frac{2}{3}} = \cdot091$  of an inch; and with 24·64 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $\cdot158 \times \frac{1}{1\frac{2}{3}} = \cdot146$  of an inch.



TABLE VI. *Continued.*SCANTLINGS, 6 IN. AND  $6\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.									
		10	11	12	13	14	15	16	17	18	20
Depth.	Breadth.	WEIGHT IN CWTs.									
6	× 2	7·20	6·54	6·00	5·53	5·14	4·80	4·50	4·23	4·00	3·60
6	× $2\frac{1}{4}$	8·10	7·36	6·75	6·23	5·78	5·40	5·06	4·76	4·50	4·05
6	× $2\frac{1}{2}$	9·00	8·18	7·50	6·92	6·42	6·00	5·62	5·29	5·00	4·50
6	× 3	10·80	9·81	9·00	8·30	7·71	7·20	6·75	6·35	6·00	5·40
*6	× $3\frac{1}{2}$	12·60	11·45	10·50	9·69	9·00	8·40	7·87	7·41	7·00	6·30
6	× 4	14·40	13·09	12·00	11·07	10·28	9·60	9·00	8·47	8·00	7·20
6	× $4\frac{1}{2}$	16·20	14·72	13·50	12·46	11·57	10·80	10·12	9·53	9·00	8·10
6	× 5	18·00	16·36	15·00	13·84	12·85	12·00	11·25	10·58	10·00	9·00
6	× $5\frac{1}{2}$	19·80	18·00	16·50	15·23	14·14	13·20	12·37	11·64	11·00	9·90
6	× 6	21·60	19·63	18·00	16·61	15·42	14·40	13·50	12·70	12·00	10·80
6	× $6\frac{1}{2}$	23·40	21·27	19·50	18·00	16·71	15·60	14·62	13·76	13·00	11·70
6	× 7	25·20	22·90	21·00	19·38	18·00	16·80	15·75	14·82	14·00	12·60
6	× 8	28·80	26·18	24·00	22·15	20·57	19·20	18·00	16·94	16·00	14·40
6	× 9	32·40	29·45	27·00	24·92	23·14	21·60	20·25	19·06	18·00	16·20
6	× 10	36·00	32·72	30·00	27·69	25·71	24·00	22·50	21·17	20·00	18·00
6	× 11	39·60	36·00	33·00	30·46	28·28	26·40	24·75	23·29	22·00	19·80
6	× 12	43·20	39·27	36·00	33·23	30·85	28·80	27·00	25·41	24·00	21·60
6	× 13	46·80	42·54	39·00	36·00	33·42	31·20	29·25	27·52	26·00	23·40
6	× 14	50·40	45·81	42·00	38·76	36·00	33·60	31·50	29·64	28·00	25·20
6	× 15	54·00	49·09	45·00	41·53	38·57	36·00	33·75	31·76	30·00	27·00

Deflection in inches of Red Pine 6 inches deep, loaded with the weights in this table.

Weight uniform. ly loaded	·274	·331	·394	·463	·537	·616	·701	·792	·887	1·096
Wt. suspended from the middle	·438	·530	·631	·741	·859	·986	1·122	1·267	1·420	1·753

\* \* For Scantlings  $6\frac{1}{2}$  inches deep, multiply the weights in this table  
by  $\frac{169}{144} = 1·1736$ , and the deflections by  $\frac{12}{13} = ·923$ .†

\* Example 1.—Red Pine 6 in. by  $3\frac{1}{2}$  in., 12 feet long, with 10·50 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·394 of an inch; and with 10·50 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·631 of an inch.

† Example 2.—Red Pine  $6\frac{1}{2}$  in. by  $3\frac{1}{2}$  in., 12 feet long, with  $10·5 \times 1·1736 = 12·32$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·394 \times \frac{12}{13} = ·363$  of an inch; and with 12·32 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·631 \times \frac{12}{13} = ·582$  of an inch.

## TABLE VII.

SCANTLINGS, 7 IN. AND  $7\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
7	× 2	98·00	49·00	32·66	24·50	19·60	16·33	14·00	12·25
7	× $2\frac{1}{4}$	110·25	55·12	36·75	27·56	22·05	18·37	15·75	13·78
7	× $2\frac{1}{2}$	122·50	61·25	40·83	30·62	24·50	20·41	17·50	15·31
7	× 3	147·00	73·50	49·00	36·75	29·40	24·50	21·00	18·37
7	× $3\frac{1}{2}$	171·50	85·75	57·16	42·87	34·30	28·58	24·50	21·43
*7	× 4	196·00	98·00	65·33	49·00	39·20	32·66	28·00	24·50
7	× $4\frac{1}{2}$	220·50	110·25	73·50	55·12	44·10	36·75	31·50	27·56
7	× 5	245·00	122·50	81·66	61·25	49·00	40·83	35·00	30·62
7	× $5\frac{1}{2}$	269·50	134·75	89·83	67·37	53·90	44·91	38·50	33·68
7	× 6	294·00	147·00	98·00	73·50	58·80	49·00	42·00	36·75
7	× 7	343·00	171·50	114·33	85·75	68·60	57·16	49·00	42·87
7	× $7\frac{1}{2}$	367·50	183·75	122·50	91·87	73·50	61·25	52·50	45·93
7	× 8	392·00	196·00	130·66	98·00	78·40	65·33	56·00	49·00
7	× 9	441·00	220·50	147·00	110·25	88·20	73·50	63·00	55·12
7	× 10	490·00	245·00	163·33	122·50	98·00	81·66	70·00	61·25
7	× 11	539·00	269·50	179·66	134·75	107·80	89·83	77·00	67·37
7	× 12	588·00	294·00	196·00	147·00	117·60	98·00	84·00	73·50
7	× 13	637·00	318·50	212·33	159·25	127·40	106·16	91·00	79·62
7	× 14	686·00	343·00	228·66	171·50	137·20	114·33	98·00	85·75
7	× 15	735·00	367·50	245·00	183·75	147·00	122·50	105·00	91·87

Deflection in inches of Red Pine 7 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·002	·009	·021	·038	·059	·085	·115	·150
Wt. suspended from the middle	·004	·015	·034	·060	·094	·135	·184	·240

\* \* \* For Scantlings  $7\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{2\frac{2}{3}}{1\frac{1}{2}} = 1·148$ , and the deflections by  $\frac{1\frac{1}{2}}{1\frac{1}{2}} = ·933$ .†

\* Example 1.—Red Pine 7 in. by 4 in., 7 feet long, with 28 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·115 of an inch; and with 28 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·184 of an inch.

† Example 2.—Red Pine  $7\frac{1}{2}$  in. by 4 in., 7 feet long, with  $28 \times 1·148 = 32·14$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·115 \times ·933 = ·107$  of an inch; and with  $32·14$  cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·184 \times ·933 = ·172$  of an inch.

TABLE VII. *Continued.*SCANTLINGS, 7 IN. AND  $7\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
7	× 2	10·88	9·80	8·90	8·16	7·53	7·00	6·53	6·12
7	× $2\frac{1}{4}$	12·25	11·02	10·02	9·18	8·48	7·87	7·35	6·89
7	× $2\frac{1}{2}$	13·61	12·25	11·13	10·20	9·42	8·75	8·16	7·65
7	× 3	16·33	14·70	13·36	12·25	11·30	10·50	9·80	9·18
7	× $3\frac{1}{2}$	19·05	17·15	15·59	14·29	13·19	12·25	11·43	10·71
*7	× 4	21·77	19·60	17·81	16·33	15·07	14·00	13·06	12·25
7	× $4\frac{1}{2}$	24·50	22·05	20·04	18·37	16·96	15·75	14·70	13·78
7	× 5	27·22	24·50	22·27	20·41	18·84	17·50	16·33	15·31
7	× $5\frac{1}{2}$	29·94	26·95	24·50	22·45	20·73	19·25	17·96	16·84
7	× 6	32·66	29·40	26·72	24·50	22·61	21·00	19·60	18·37
7	× 7	38·11	34·30	31·18	28·58	26·38	24·50	22·86	21·43
7	× $7\frac{1}{2}$	40·83	36·75	33·40	30·62	28·26	26·25	24·50	22·96
7	× 8	43·55	39·20	35·63	32·66	30·15	28·00	26·13	24·50
7	× 9	49·00	44·10	40·09	36·75	33·92	31·50	29·40	27·56
7	× 10	54·44	49·00	44·54	40·83	37·69	35·00	32·66	30·62
7	× 11	59·88	53·90	49·00	44·91	41·46	38·50	35·93	33·68
7	× 12	65·33	58·80	53·45	49·00	45·23	42·00	39·20	36·75
7	× 13	70·77	63·70	57·90	53·08	49·00	45·50	42·46	39·81
7	× 14	76·22	68·60	62·36	57·16	52·76	49·00	45·73	42·87
7	× 15	81·66	73·50	66·81	61·25	56·53	52·50	49·00	45·93

Deflection in inches of Red Pine 7 inches deep, loaded with the weights in this table.

Weight uniform. ly loaded	·190	·235	·284	·338	·397	·460	·528	·601
Wt. suspended from the middle	·304	·376	·455	·541	·635	·736	·845	·962

\* \* \* For Scantlings  $7\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{2\frac{2}{3}}{1\frac{1}{3}} = 1·48$ , and the deflections by  $\frac{1}{1\frac{1}{3}} = ·933$ .†

\* Example 1.—Red Pine  $7\frac{1}{2}$  in. by 4 in., 14 feet long, with 14 cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·460$  of an inch; and with 14 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·736$  of an inch.

†\* Example 2.—Red Pine,  $7\frac{1}{2}$  in. by 4 in., 14 feet long, with  $14 \times 1·48 = 16·07$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·46 \times ·933 = ·429$  of an inch; and with 16·07 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·736 \times ·933 = ·687$  of an inch.



TABLE VII. *Continued.*SCANTLINGS, 7 IN. AND  $7\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
7	× 2	5·76	5·44	5·15	4·90	4·66	4·45	4·26	4·08
7	× $2\frac{1}{4}$	6·48	6·12	5·80	5·51	5·25	5·01	4·79	4·59
7	× $2\frac{1}{2}$	7·20	6·80	6·44	6·12	5·83	5·56	5·32	5·10
7	× 3	8·64	8·16	7·73	7·35	7·00	6·68	6·39	6·12
7	× $3\frac{1}{2}$	10·08	9·52	9·02	8·57	8·16	7·79	7·45	7·14
*7	× 4	11·52	10·88	10·31	9·80	9·33	8·90	8·52	8·16
7	× $4\frac{1}{2}$	12·97	12·25	11·60	11·02	10·50	10·02	9·58	9·18
7	× 5	14·41	13·61	12·89	12·25	11·66	11·13	10·65	10·20
7	× $5\frac{1}{2}$	15·85	14·97	14·18	13·47	12·83	12·25	11·71	11·22
7	× 6	17·29	16·33	15·47	14·70	14·00	13·36	12·78	12·25
7	× 7	20·17	19·05	18·05	17·15	16·33	15·59	14·91	14·29
7	× $7\frac{1}{2}$	21·61	20·41	19·34	18·37	17·50	16·70	15·97	15·31
7	× 8	23·05	21·77	20·63	19·60	18·66	17·81	17·04	16·33
7	× 9	25·94	24·50	23·21	22·05	21·00	20·04	19·17	18·37
7	× 10	28·82	27·22	25·78	24·50	23·33	22·27	21·30	20·41
7	× 11	31·70	29·94	28·36	26·95	25·66	24·50	23·43	22·45
7	× 12	34·58	32·66	30·94	29·40	28·00	26·72	25·56	24·50
7	× 13	37·47	35·38	33·52	31·85	30·33	28·95	27·69	26·54
7	× 14	40·35	38·11	36·10	34·30	32·66	31·18	29·82	28·58
7	× 15	43·23	40·83	38·68	36·75	35·00	33·40	31·95	30·62

Deflection in inches of Red Pine 7 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·678	·761	·848	·939	1·035	1·136	1·242	1·352
Wt. suspended from the middle	1·086	1·217	1·356	1·503	1·657	1·818	1·987	2·164

\* \* \* For Scantlings  $7\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{225}{196} = 1·148$ , and the deflections by  $\frac{147}{196} = ·933$ .†

\* *Example 1.*—Red Pine 7 in. by 4 in., 21 feet long, with 9·33 cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $1·035$  inches; and with 9·33 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·657$  inches.

† \* *Example 2.*—Red Pine  $7\frac{1}{2}$  in. by 4 in., 21 feet long, with  $9·33 \times 1·148 = 10·71$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $1·035 \times ·933 = ·966$  of an inch; and with 10·71 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·657 \times ·933 = 1·546$  inches.



## TABLE VIII.

SCANTLINGS, 8 IN. AND  $8\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
8	× 2	128·00	64·00	42·66	32·00	25·60	21·33	18·28	16·00
8	× $2\frac{1}{4}$	144·00	72·00	48·00	36·00	28·80	24·00	20·57	18·00
8	× $2\frac{1}{2}$	160·00	80·00	53·33	40·00	32·00	26·66	22·85	20·00
8	× 3	192·00	96·00	64·00	48·00	38·40	32·00	27·42	24·00
8	× $3\frac{1}{2}$	224·00	112·00	74·66	56·00	44·80	37·33	32·00	28·00
8	× 4	256·00	128·00	85·33	64·00	51·20	42·66	36·57	32·00
*8	× $4\frac{1}{2}$	288·00	144·00	96·00	72·00	57·60	48·00	41·14	36·00
8	× 5	320·00	160·00	106·66	80·00	64·00	53·33	45·71	40·00
8	× $5\frac{1}{2}$	352·00	176·00	117·33	88·00	70·40	58·66	50·28	44·00
8	× 6	384·00	192·00	128·00	96·00	76·80	64·00	54·85	48·00
8	× 7	448·00	224·00	149·33	112·00	89·60	74·66	64·00	56·00
8	× 8	512·00	256·00	170·66	128·00	102·40	85·33	73·14	64·00
8	× $8\frac{1}{2}$	544·00	272·00	181·33	136·00	108·80	90·66	77·71	68·00
8	× 9	576·00	288·00	192·00	144·00	115·20	96·00	82·28	72·00
8	× 10	640·00	320·00	213·33	160·00	128·00	106·66	91·42	80·00
8	× 11	704·00	352·00	234·66	176·00	140·80	117·33	100·57	88·00
8	× 12	768·00	384·00	256·00	192·00	153·60	128·00	109·71	96·00
8	× 13	832·00	416·00	277·33	208·00	166·40	138·66	118·85	104·00
8	× 14	896·00	448·00	298·66	224·00	179·20	149·33	128·00	112·00
8	× 15	960·00	480·00	320·00	240·00	192·00	160·00	137·14	120·00

Deflection in inches of Red Pine 8 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·002	·008	·018	·033	·051	·074	·101	·131
Wt. suspended from the middle	·003	·013	·030	·053	·082	·118	·161	·210

\* \* \* For Scantlings  $8\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{2 \cdot 8 \cdot 9}{5 \cdot 0} = 1 \cdot 1289$ , and the deflections by  $\frac{1 \cdot 6}{1 \cdot 7} = \cdot 941$ .†

\* Example 1.—Red Pine 8 in. by  $4\frac{1}{2}$  in., 8 feet long, with 36 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·131 of an inch; and with 36 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·210 of an inch.

†\* Example 2.—Red Pine  $8\frac{1}{2}$  in. by  $4\frac{1}{2}$  in., 8 feet long, with  $36 \times 1 \cdot 1289 = 40 \cdot 64$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $\cdot 131 \times \cdot 941 = \cdot 123$  of an inch; and with 40·64 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $\cdot 21 \times \cdot 941 = \cdot 198$  of an inch.

TABLE VIII. *Continued.*SCANTLINGS, 8 IN. AND  $8\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth	WEIGHT IN CWTs.							
8	× 2	14·22	12·80	11·63	10·66	9·84	9·14	8·53	8·00
8	× $2\frac{1}{4}$	16·00	14·40	13·09	12·00	11·07	10·28	9·60	9·00
8	× $2\frac{1}{2}$	17·77	16·00	14·54	13·33	12·30	11·42	10·66	10·00
8	× 3	21·33	19·20	17·45	16·00	14·76	13·71	12·80	12·00
8	× $3\frac{1}{2}$	24·88	22·40	20·36	18·66	17·23	16·00	14·93	14·00
8	× 4	28·44	25·60	23·27	21·33	19·69	18·28	17·06	16·00
*8	× $4\frac{1}{2}$	32·00	28·80	26·18	24·00	22·15	20·57	19·20	18·00
8	× 5	35·55	32·00	29·09	26·66	24·61	22·85	21·33	20·00
8	× $5\frac{1}{2}$	39·11	35·20	32·00	29·33	27·07	25·14	23·46	22·00
8	× 6	42·66	38·40	34·90	32·00	29·53	27·42	25·60	24·00
8	× 7	49·77	44·80	40·72	37·33	34·46	32·00	29·86	28·00
8	× 8	56·88	51·20	46·54	42·66	39·38	36·57	34·13	32·00
8	× $8\frac{1}{2}$	60·44	54·40	49·45	45·33	41·84	38·85	36·26	34·00
8	× 9	64·00	57·60	52·36	48·00	44·30	41·14	38·40	36·00
8	× 10	71·11	64·00	58·18	53·33	49·23	45·71	42·66	40·00
8	× 11	78·22	70·40	64·00	58·66	54·15	50·28	46·93	44·00
8	× 12	85·33	76·80	69·81	64·00	59·07	54·85	51·20	48·00
8	× 13	92·44	83·20	75·63	69·33	64·00	59·42	55·46	52·00
8	× 14	99·55	89·60	81·45	74·66	68·92	64·00	59·73	56·00
8	× 15	106·66	96·00	87·27	80·00	73·84	68·57	64·00	60·00

Deflection in inches of Red Pine 8 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·166	·205	·249	·296	·347	·403	·462	·526
Wt. suspended from the middle	·266	·329	·398	·473	·556	·644	·740	·841

\* \* \* For Scantlings  $8\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{2}{3} \cdot \frac{8}{5} = 1·1289$ , and the deflections by  $\frac{1}{17} = ·941$ .†

\* *Example 1.*—Red Pine 8 in. by  $4\frac{1}{2}$  in., 16 feet long, with 18 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·526 of an inch; and with 18 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·841 of an inch.

† *Example 2.*—Red Pine  $8\frac{1}{2}$  in. by  $4\frac{1}{2}$  in., 16 feet long, with  $18 \times 1·1289 = 20·32$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·526 \times ·941 = ·495$  of an inch; and with 20·32 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·841 \times ·941 = ·791$  of an inch.

TABLE VIII. *Continued.*SCANTLINGS, 8 IN. AND  $8\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
8	× 2	7·52	7·11	6·73	6·40	6·09	5·81	5·56	5·33
8	× $2\frac{1}{4}$	8·47	8·00	7·57	7·20	6·85	6·54	6·26	6·00
8	× $2\frac{1}{2}$	9·41	8·88	8·42	8·00	7·61	7·27	6·95	6·66
8	× 3	11·29	10·66	10·10	9·60	9·14	8·72	8·34	8·00
8	× $3\frac{1}{2}$	13·17	12·44	11·78	11·20	10·66	10·18	9·73	9·33
8	× 4	15·05	14·22	13·47	12·80	12·19	11·63	11·13	10·66
*8	× $4\frac{1}{2}$	16·94	16·00	15·15	14·40	13·71	13·09	12·52	12·00
8	× 5	18·82	17·77	16·84	16·00	15·23	14·54	13·91	13·33
8	× $5\frac{1}{2}$	20·70	19·55	18·52	17·60	16·76	16·00	15·30	14·66
8	× 6	22·58	21·33	20·21	19·20	18·28	17·45	16·69	16·00
8	× 7	26·35	24·88	23·57	22·40	21·33	20·36	19·47	18·66
8	× 8	30·11	28·44	26·94	25·60	24·38	23·27	22·26	21·33
8	× $8\frac{1}{2}$	32·00	30·22	28·63	27·20	25·90	24·72	23·65	22·66
8	× 9	33·88	32·00	30·31	28·80	27·42	26·18	25·04	24·00
8	× 10	37·64	35·55	33·68	32·00	30·47	29·09	27·82	26·66
8	× 11	41·41	39·11	37·05	35·20	33·52	32·00	30·60	29·33
8	× 12	45·17	42·66	40·42	38·40	36·57	34·90	33·39	32·00
8	× 13	48·94	46·22	43·78	41·60	39·61	37·81	36·17	34·66
8	× 14	52·70	49·77	47·15	44·80	42·66	40·72	38·95	37·33
8	× 15	56·47	53·33	50·52	48·00	45·71	43·63	41·73	40·00

Deflection in inches of Red Pine 8 inches deep, loaded with the weights in this table.

Weight uniform. ly loaded.	·594	·666	·742	·822	·906	·994	1·087	1·183
Wt. suspended from the middle	·950	1·065	1·187	1·315	1·450	1·591	1·739	1·893

\* \* \* For Scantlings  $8\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{2 \cdot 89}{5 \cdot 6} = 1·1289$ , and the deflections by  $\frac{1 \cdot 6}{1 \cdot 7} = ·941$ .

\* *Example 1.*—Red Pine 8 in. by  $4\frac{1}{2}$  in., 24 feet long, with 12 cwts. uniformly loaded, (one-eighth the breaking weight) deflects 1·183 inches; and with 12 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is 1·893 inches.

† \* *Example 2.*—Red Pine  $8\frac{1}{2}$  in. by  $4\frac{1}{2}$  in., 24 feet long, with  $12 \times 1·1289 = 13·54$  cwts. uniformly loaded, (one-eighth the breaking weight) deflects  $1·183 \times ·941 = 1·113$  inches; and with  $13·54$  cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·893 \times ·941 = 1·781$  inches.



## TABLE IX.

SCANTLINGS, 9 IN. AND  $9\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
9	× 2	162·00	81·00	54·00	40·50	32·40	27·00	23·14	20·25
9	× $2\frac{1}{4}$	182·25	91·12	60·75	45·56	36·45	30·37	26·03	22·78
9	× $2\frac{1}{2}$	202·50	101·25	67·50	50·62	40·50	33·75	28·92	25·31
9	× 3	243·00	121·50	81·00	60·75	48·60	40·50	34·71	30·37
9	× $3\frac{1}{2}$	283·50	141·75	94·50	70·87	56·70	47·25	40·50	35·43
9	× 4	324·00	162·00	108·00	81·00	64·80	54·00	46·28	40·50
9	× $4\frac{1}{2}$	364·50	182·25	121·50	91·12	72·90	60·75	52·07	45·56
* 9	× 5	405·00	202·50	135·00	101·25	81·00	67·50	57·85	50·62
9	× $5\frac{1}{2}$	445·50	222·75	148·50	111·37	89·10	74·25	63·64	55·68
9	× 6	486·00	243·00	162·00	121·50	97·20	81·00	69·42	60·75
9	× 7	567·00	283·50	189·00	141·75	113·40	94·50	81·00	70·87
9	× 8	648·00	324·00	216·00	162·00	129·60	108·00	92·57	81·00
9	× 9	729·00	364·50	243·00	182·25	145·80	121·50	104·14	91·12
9	× $9\frac{1}{2}$	769·50	384·75	256·50	192·37	153·90	128·25	109·92	96·18
9	× 10	810·00	405·00	270·00	202·50	162·00	135·00	115·71	101·25
9	× 11	891·00	445·50	297·00	222·75	178·20	148·50	127·28	111·37
9	× 12	972·00	486·00	324·00	243·00	194·40	162·00	138·85	121·50
9	× 13	1053·00	526·50	351·00	263·25	210·60	175·50	150·42	131·62
9	× 14	1134·00	567·00	378·00	283·50	226·80	189·00	162·00	141·75
9	× 15	1215·00	607·50	405·00	303·75	243·00	202·50	173·57	151·87

Deflection in inches of Red Pine 9 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·002	·007	·016	·029	·046	·066	·089	·117
Wt. suspended from the middle	·003	·012	·026	·047	·073	·105	·143	·187

\* \* For Scantlings  $9\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{3}{2} \cdot \frac{1}{24} = 1·1142$ , and the deflections by  $\frac{1}{1} \cdot \frac{8}{9} = ·947$ .

\* *Example 1.*—Red Pine 9 in. by 5 in., 5 feet long, with 81 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·046 of an inch; and with 81 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·073 of an inch.

† \* *Example 2.*—Red Pine  $9\frac{1}{2}$  in. by 5 in., 5 feet long, with  $81 \times 1·1142 = 90·25$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·046 \times ·947 = ·044$  of an inch; and with 90·25 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·073 \times ·947 = ·069$  of an inch.



TABLE IX. *Continued.*SCANTLINGS, 9 IN. AND  $9\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
9	× 2	18·00	16·20	14·72	13·50	12·46	11·57	10·80	10·12
9	× 2¼	20·25	18·22	16·56	15·18	14·01	13·01	12·15	11·38
9	× 2½	22·50	20·25	18·40	16·87	15·57	14·46	13·50	12·65
9	× 3	27·00	24·30	22·09	20·25	18·69	17·35	16·20	15·18
9	× 3½	31·50	28·35	25·77	23·62	21·80	20·25	18·90	17·71
*9	× 4	36·00	32·40	29·45	27·00	24·92	23·14	21·60	20·25
	× 4½	40·50	36·45	33·13	30·37	28·03	26·03	24·30	22·78
	× 5	45·00	40·50	36·81	33·75	31·15	28·92	27·00	25·31
	× 5½	49·50	44·55	40·50	37·12	34·26	31·82	29·70	27·84
	× 6	54·00	48·60	44·18	40·50	37·38	34·71	32·40	30·37
9	× 7	63·00	56·70	51·54	47·25	43·61	40·50	37·80	35·43
9	× 8	72·00	64·80	58·90	54·00	49·84	46·28	43·20	40·50
9	× 9	81·00	72·90	66·27	60·75	56·07	52·07	48·60	45·56
9	× 9½	85·50	76·95	69·95	64·12	59·19	54·96	51·30	48·09
9	× 10	90·00	81·00	73·63	67·50	62·30	57·85	54·00	50·62
9	× 11	99·00	89·10	81·00	74·25	68·53	63·64	59·40	55·68
9	× 12	108·00	97·20	88·36	81·00	74·76	69·42	64·80	60·75
9	× 13	117·00	105·30	95·72	87·75	81·00	75·21	70·20	65·81
9	× 14	126·00	113·40	103·09	94·50	87·23	81·00	75·60	70·87
9	× 15	135·00	121·50	110·45	101·25	93·46	86·78	81·00	75·93

Deflection in inches of Red Pine 9 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·148	·183	·221	·263	·309	·358	·411	·467
Wt. suspended from the middle	·237	·292	·354	·421	·494	·573	·657	·748

\* \* \* For Scantlings  $9\frac{1}{2}$  inches deep, multiply the weights in this table  
by  $\frac{3\frac{1}{2}}{3\frac{1}{4}} = 1·1142$ , and the deflections by  $\frac{1\frac{1}{2}}{1\frac{1}{8}} = ·947$ .

\* Example 1.—Red Pine 9 in. by 5 in., 9 feet long, with 45 cwt. uniformly loaded,  
(one-eighth the breaking weight) deflects ·148 of an inch; and with 45 cwt. suspended from  
the middle, (one-fourth the breaking weight) the deflection is ·237 of an inch.

\* Example 2.—Red Pine  $9\frac{1}{2}$  in. by 5 in., 9 feet long, with  $45 \times 1·1142 = 50·13$  cwt.  
uniformly loaded, (one-eighth the breaking weight) deflects  $·148 \times ·947 = ·140$  of an inch;  
and with 50·13 cwt. suspended from the middle, (one-fourth the breaking weight) the  
deflection is  $·237 \times ·947 = ·224$  of an inch.

TABLE IX. *Continued.*SCANTLINGS, 9 IN. AND  $9\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth	WEIGHT IN CWTs.							
9 × 2		9·52	9·00	8·52	8·10	7·71	7·36	7·04	6·75
9 × $2\frac{1}{4}$		10·72	10·12	9·59	9·11	8·67	8·28	7·92	7·59
9 × $2\frac{1}{2}$		11·91	11·25	10·65	10·12	9·64	9·20	8·80	8·43
9 × 3		14·29	13·50	12·78	12·15	11·57	11·04	10·56	10·12
9 × $3\frac{1}{2}$		16·67	15·75	14·92	14·17	13·50	12·88	12·32	11·81
9 × 4		19·05	18·00	17·05	16·20	15·42	14·72	14·08	13·50
9 × $4\frac{1}{2}$		21·44	20·25	19·18	18·22	17·35	16·56	15·84	15·18
9 × 5		23·82	22·50	21·31	20·25	19·28	18·40	17·60	16·87
9 × $5\frac{1}{2}$		26·20	24·75	23·44	22·27	21·21	20·25	19·36	18·56
9 × 6		28·58	27·00	25·57	24·30	23·14	22·09	21·13	20·25
9 × 7		33·35	31·50	29·84	28·35	27·00	25·77	24·65	23·62
9 × 8		38·11	36·00	34·10	32·40	30·85	29·45	28·17	27·00
9 × 9		42·88	40·50	38·36	36·45	34·71	33·13	31·69	30·37
*9 × $9\frac{1}{2}$		45·26	42·75	40·50	38·47	36·64	34·97	33·45	32·06
9 × 10		47·64	45·00	42·63	40·50	38·57	36·81	35·21	33·75
9 × 11		52·41	49·50	46·89	44·55	42·42	40·50	38·73	37·12
9 × 12		57·17	54·00	51·15	48·60	46·28	44·18	42·26	40·50
9 × 13		61·94	58·50	55·42	52·65	50·14	47·86	45·78	43·87
9 × 14		66·70	63·00	59·68	56·70	54·00	51·54	49·30	47·25
9 × 15		71·47	67·50	63·94	60·75	57·85	55·22	52·82	50·62

Deflection in inches of Red Pine 9 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·528	·592	·659	·730	·805	·884	·966	1·052
Wt. suspended from the middle	·844	·947	1·055	1·169	1·289	1·414	1·546	1·683

\* \* \* For Scantlings  $9\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{3\frac{1}{2}}{3\frac{1}{4}} = 1·1142$ , and the deflections by  $\frac{1\frac{1}{2}}{1\frac{1}{3}} = ·947$ .†

\* Example 1.—Red Pine 9 in. by  $9\frac{1}{2}$  in., 17 feet long, with 45·26 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·528 of an inch; and with 45·26 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·844 of an inch.

† Example 2.—Red Pine  $9\frac{1}{2}$  in. by  $9\frac{1}{2}$  in., 17 feet long, with  $45·26 \times 1·1142 = 50·42$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·528 \times ·947 = ·500$  of an inch; and with 50·42 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·844 \times ·947 = ·799$  of an inch.

TABLE X.

SCANTLINGS, 10 IN. AND  $10\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	1	2	3	4	5	6	7	8
Depth. Breadth.	WEIGHT IN CWTs.							
10 × 2	200·00	100·00	66·66	50·00	40·00	33·33	28·57	25·00
10 × $2\frac{1}{4}$	225·00	112·50	75·00	56·25	45·00	37·50	32·14	28·12
10 × $2\frac{1}{2}$	250·00	125·00	83·33	62·50	50·00	41·66	35·71	31·25
10 × 3	300·00	150·00	100·00	75·00	60·00	50·00	42·85	37·50
10 × $3\frac{1}{2}$	350·00	175·00	116·66	87·50	70·00	58·33	50·00	43·75
10 × 4	400·00	200·00	133·33	100·00	80·00	66·66	57·14	50·00
10 × $4\frac{1}{2}$	450·00	225·00	150·00	112·50	90·00	75·00	64·28	56·25
10 × 5	500·00	250·00	166·66	125·00	100·00	83·33	71·42	62·50
10 × $5\frac{1}{2}$	550·00	275·00	183·33	137·50	110·00	91·66	78·57	68·75
* 10 × 6	600·00	300·00	200·00	150·00	120·00	100·00	85·71	75·00
10 × 7	700·00	350·00	233·33	175·00	140·00	116·66	100·00	87·50
10 × 8	800·00	400·00	266·66	200·00	160·00	133·33	114·28	100·00
10 × 9	900·00	450·00	300·00	225·00	180·00	150·00	128·57	112·50
10 × 10	1000·00	500·00	333·33	250·00	200·00	166·66	142·85	125·00
10 × $10\frac{1}{2}$	1050·00	525·00	350·00	262·50	210·00	175·00	150·00	131·25
10 × 11	1100·00	550·00	366·66	275·00	220·00	183·33	157·14	137·50
10 × 12	1200·00	600·00	400·00	300·00	240·00	200·00	171·42	150·00
10 × 13	1300·00	650·00	433·33	325·00	260·00	216·66	185·71	162·50
10 × 14	1400·00	700·00	466·66	350·00	280·00	233·33	200·00	175·00
10 × 15	1500·00	750·00	500·00	375·00	300·00	250·00	214·28	187·50

Deflection in inches of Red Pine 10 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·002	·007	·015	·026	·041	·059	·081	·105
Wt. suspended from the middle	·003	·011	·024	·042	·066	·095	·129	·168

\*\*\* For Scantlings  $10\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{4\frac{1}{2}}{4\frac{1}{2}} = 1·1025$ , and the deflections by  $\frac{2\frac{1}{2}}{2\frac{1}{2}} = ·952$ .†

\* Example 1.—Red Pine 10 in. by 6 in., 6 feet long, with 100 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·059 of an inch; and with 100 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·095 of an inch.

† Example 2.—Red Pine  $10\frac{1}{2}$  in. by 6 in., 6 feet long, with  $100 \times 1·1025 = 110·25$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·059 \times ·952 = ·056$  of an inch; and with  $110·25$  cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·095 \times ·952 = ·090$  of an inch.



TABLE X. *Continued.*SCANTLINGS, 10 IN. AND  $10\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
10 × 2		22·22	20·00	18·18	16·66	15·38	14·28	13·33	12·50
10 × $2\frac{1}{4}$		25·00	22·50	20·45	18·75	17·30	16·07	15·00	14·06
10 × $2\frac{1}{2}$		27·77	25·00	22·72	20·83	19·23	17·85	16·66	15·62
10 × 3		33·33	30·00	27·27	25·00	23·07	21·42	20·00	18·75
10 × $3\frac{1}{2}$		38·88	35·00	31·81	29·16	26·92	25·00	23·33	21·87
10 × 4		44·44	40·00	36·36	33·33	30·76	28·57	26·66	25·00
10 × $4\frac{1}{2}$		50·00	45·00	40·90	37·50	34·61	32·14	30·00	28·12
10 × 5		55·55	50·00	45·45	41·66	38·46	35·71	33·33	31·25
10 × $5\frac{1}{2}$		61·11	55·00	50·00	45·83	42·30	39·28	36·66	34·37
* 10 × 6		66·66	60·00	54·54	50·00	46·15	42·85	40·00	37·50
10 × 7		77·77	70·00	63·63	58·33	53·84	50·00	46·66	43·75
10 × 8		88·88	80·00	72·72	66·66	61·53	57·14	53·33	50·00
10 × 9		100·00	90·00	81·81	75·00	69·23	64·28	60·00	56·25
10 × 10		111·11	100·00	90·90	83·33	76·92	71·42	66·66	62·50
10 × $10\frac{1}{2}$		116·66	105·00	95·45	87·50	80·76	75·00	70·00	65·62
10 × 11		122·22	110·00	100·00	91·66	84·61	78·57	73·33	68·75
10 × 12		133·33	120·00	109·09	100·00	92·30	85·71	80·00	75·00
10 × 13		144·44	130·00	118·18	108·33	100·00	92·85	86·66	81·25
10 × 14		155·55	140·00	127·27	116·66	107·69	100·00	93·33	87·50
10 × 15		166·66	150·00	136·36	125·00	115·38	107·14	100·00	93·75

Deflection in inches of Red Pine 10 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·133	·164	·199	·237	·278	·322	·370	·421
Wt. suspended from the middle	·213	·263	·318	·379	·444	·515	·592	·673

\* \* For Scantlings  $10\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{4\frac{1}{2}}{4\frac{1}{2}} = 1·1025$ , and the deflections by  $\frac{2\frac{1}{2}}{2\frac{1}{2}} = ·952$ .†

\* Example 1.—Red Pine 10 in. by 6 in., 10 feet long, with 60 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·164 of an inch; and with 60 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·263 of an inch.

† Example 2.—Red Pine  $10\frac{1}{2}$  in. by 6 in., 10 feet long, with  $60 \times 1·1025 = 66·15$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·164 \times ·952 = ·156$  of an inch; and with 66·15 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·263 \times ·952 = ·250$  of an inch.



TABLE X. *Continued.*SCANTLINGS, 10 IN. AND  $10\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
10 × 2		11·76	11·11	10·52	10·00	9·52	9·09	8·69	8·33
10 × $2\frac{1}{4}$		13·23	12·50	11·84	11·25	10·71	10·22	9·78	9·37
10 × $2\frac{1}{2}$		14·70	13·88	13·15	12·50	11·90	11·36	10·86	10·41
10 × 3		17·64	16·66	15·78	15·00	14·28	13·63	13·04	12·50
10 × $3\frac{1}{2}$		20·58	19·44	18·42	17·50	16·66	15·90	15·21	14·58
10 × 4		23·52	22·22	21·05	20·00	19·04	18·18	17·39	16·66
10 × $4\frac{1}{2}$		26·47	25·00	23·68	22·50	21·42	20·45	19·56	18·75
10 × 5		29·41	27·77	26·31	25·00	23·80	22·72	21·73	20·83
10 × $5\frac{1}{2}$		32·35	30·55	28·94	27·50	26·19	25·00	23·91	22·91
* 10 × 6		35·29	33·33	31·57	30·00	28·57	27·27	26·08	25·00
10 × 7		41·17	38·88	36·84	35·00	33·33	31·81	30·43	29·16
10 × 8		47·05	44·44	42·10	40·00	38·09	36·36	34·78	33·33
10 × 9		52·94	50·00	47·36	45·00	42·85	40·90	39·13	37·50
10 × 10		58·82	55·55	52·63	50·00	47·61	45·45	43·47	41·66
10 × $10\frac{1}{2}$		61·76	58·33	55·26	52·50	50·00	47·72	45·65	43·75
10 × 11		64·70	61·11	57·89	55·00	52·38	50·00	47·82	45·83
10 × 12		70·58	66·66	63·15	60·00	57·14	54·54	52·17	50·00
10 × 13		76·47	72·22	68·42	65·00	61·90	59·09	56·52	54·16
10 × 14		82·35	77·77	73·68	70·00	66·66	63·63	60·86	58·33
10 × 15		88·23	83·33	78·94	75·00	71·42	68·18	65·21	62·50

Deflection in inches of Red Pine 10 inches deep, loaded with the weights in this table.

Weight uniform. ly loaded	·475	·532	·593	·657	·725	·795	·869	·947
Wt. suspended from the middle	·760	·852	·949	1·052	1·160	1·273	1·391	1·515

\* \* For Scantlings  $10\frac{1}{2}$  inches deep, multiply the weights in this table  
by  $\frac{4 \times 4 \times 1}{8} = 1·1025$ , and the deflections by  $\frac{2 \times 0}{1} = ·952$ .†.

\* Example 1.—Red Pine 10 in. by 6 in., 18 feet long, with 33·33 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·532 of an inch; and with 33·33 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·852 of an inch.

† \* Example 2.—Red Pine  $10\frac{1}{2}$  in. by 6 in., 18 feet long, with  $33·33 \times 1·1025 = 36·75$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·532 × ·952 = ·506 of an inch; and with 36·75 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·852 × ·952 = ·811 of an inch.

TABLE XI.

## SCANTLINGS, 11 IN. AND 11½ INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
11 × 2		242·00	121·00	80·66	60·50	48·40	40·33	34·57	30·25
11 × 2½		272·25	136·12	90·75	68·06	54·45	45·37	38·89	34·03
11 × 2½		302·50	151·25	100·83	75·62	60·50	50·41	43·21	37·81
11 × 3		363·00	181·50	121·00	90·75	72·60	60·50	51·85	45·37
11 × 3½		423·50	211·75	141·16	105·87	84·70	70·58	60·50	52·93
11 × 4		484·00	242·00	161·33	121·00	96·80	80·66	69·14	60·50
11 × 4½		544·50	272·25	181·50	136·12	108·90	90·75	77·78	68·06
11 × 5		605·00	302·50	201·66	151·25	121·00	100·83	86·42	75·62
11 × 5½		665·50	332·75	221·83	166·37	133·10	110·91	95·07	83·18
11 × 6		726·00	363·00	242·00	181·50	145·20	121·00	103·71	90·75
* 11 × 7		847·00	423·50	282·33	211·75	169·40	141·16	121·00	105·87
11 × 8		968·00	484·00	322·66	242·00	193·60	161·33	138·28	121·00
11 × 9		1089·00	544·50	363·00	272·25	217·80	181·50	155·57	136·12
11 × 10		1210·00	605·00	403·33	302·50	242·00	201·66	172·85	151·25
11 × 11		1331·00	665·50	443·66	332·75	266·20	221·83	190·14	166·37
11 × 11½		1391·50	695·75	463·83	347·87	278·30	231·91	198·78	173·93
11 × 12		1452·00	726·00	484·00	363·00	290·40	242·00	207·42	181·50
11 × 13		1573·00	786·50	524·33	393·25	314·60	262·16	224·71	196·62
11 × 14		1694·00	847·00	564·66	423·50	338·80	282·33	242·00	211·75
11 × 15		1815·00	907·50	605·00	453·75	363·00	302·50	259·28	226·87

Deflection in inches of Red Pine 11 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·001	·006	·013	·024	·037	·054	·073	·096
Wt. suspended from the middle	·002	·010	·022	·038	·060	·086	·117	·153

\* \* \* For Scantlings 11½ inches deep, multiply the weights in this table by  $\frac{5 \cdot 2 \cdot 9}{4 \cdot 3 \cdot 4} = 1·093$ , and the deflections by  $\frac{2 \cdot 2}{3} = ·956$ .†

\* Example 1.—Red Pine 11 in. by 7 in., 7 feet long, with 121 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·073 of an inch; and with 121 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·117 of an inch.

† Example 2.—Red Pine 11½ in. by 7 in., 7 feet long, with  $121 \times 1·093 = 132·25$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·073 \times ·956 = ·070$  of an inch; and with 132·25 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·117 \times ·956 = ·112$  of an inch.

TABLE XI. *Continued.*SCANTLINGS, 11 IN. AND  $11\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.						
		9	10	11	12	13	14	15
Depth.	Breadth.	WEIGHT IN CWTs.						
11 × 2		26·88	24·20	22·00	20·16	18·61	17·28	16·13
11 × $2\frac{1}{4}$		30·25	27·22	24·75	22·68	20·94	19·44	18·15
11 × $2\frac{1}{2}$		33·61	30·25	27·50	25·20	23·26	21·60	20·16
11 × 3		40·33	36·30	33·00	30·25	27·92	25·92	24·20
11 × $3\frac{1}{2}$		47·05	42·35	38·50	35·29	32·57	30·25	28·23
11 × 4		53·77	48·40	44·00	40·33	37·23	34·57	32·26
11 × $4\frac{1}{2}$		60·50	54·45	49·50	45·37	41·88	38·89	36·30
11 × 5		67·22	60·50	55·00	50·41	46·53	43·21	40·33
11 × $5\frac{1}{2}$		73·94	66·55	60·50	55·45	51·19	47·53	44·36
11 × 6		80·66	72·60	66·00	60·50	55·84	51·85	48·40
* 11 × 7		94·11	84·70	77·00	70·58	65·15	60·50	56·46
11 × 8		107·55	96·80	88·00	80·66	74·46	69·14	64·53
11 × 9		121·00	108·90	99·00	90·75	83·76	77·78	72·60
11 × 10		134·44	121·00	110·00	100·83	93·07	86·42	80·66
11 × 11		147·88	133·10	121·00	110·91	102·38	95·07	88·73
11 × $11\frac{1}{2}$		154·61	139·15	126·50	115·95	107·03	99·39	92·76
11 × 12		161·33	145·20	132·00	121·00	111·69	103·71	96·80
11 × 13		174·77	157·30	143·00	131·08	121·00	112·35	104·86
11 × 14		188·22	169·40	154·00	141·16	130·30	121·00	112·93
11 × 15		201·66	181·50	165·00	151·25	139·61	129·64	121·00

Deflection in inches of Red Pine 11 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·121	·149	·181	·215	·253	·293	·336	·382
Wt. suspended from the middle	·194	·239	·289	·344	·404	·468	·538	·612

\* \* \* For Scantlings  $11\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{5}{4} \times \frac{2}{3} = 1·093$ , and the deflections by  $\frac{2}{3} = ·956$ .†

\* Example 1.—Red Pine 11 in. by 7 in., 11 feet long, with 77 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·181 of an inch; and with 77 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·289 of an inch.

† \* Example 2.—Red Pine  $11\frac{1}{2}$  in. by 7 in., 11 feet long, with  $77 \times 1·093 = 84·16$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·181 \times ·956 = ·173$  of an inch; and with 84·16 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·289 \times ·956 = ·276$  of an inch.



TABLE XI. *Continued.*SCANTLINGS, 11 IN. AND  $11\frac{1}{2}$  INCHES DEEP.

The Weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
11 × 2		14·23	13·44	12·73	12·10	11·52	11·00	10·52	10·08
11 × 2 $\frac{1}{4}$		16·01	15·12	14·32	13·61	12·96	12·37	11·83	11·34
11 × 2 $\frac{1}{2}$		17·79	16·81	15·92	15·12	14·40	13·75	13·15	12·60
11 × 3		21·35	20·16	19·10	18·15	17·28	16·50	15·78	15·12
11 × 3 $\frac{1}{2}$		24·91	23·52	22·28	21·17	20·16	19·25	18·41	17·64
11 × 4		28·47	26·88	25·47	24·20	23·04	22·00	21·04	20·16
11 × 4 $\frac{1}{2}$		32·02	30·25	28·65	27·22	25·92	24·75	23·67	22·68
11 × 5		35·58	33·61	31·84	30·25	28·80	27·50	26·30	25·20
11 × 5 $\frac{1}{2}$		39·14	36·97	35·02	33·27	31·69	30·25	28·93	27·72
11 × 6		42·70	40·33	38·21	36·30	34·57	33·00	31·56	30·25
* 11 × 7		49·82	47·05	44·57	42·35	40·33	38·50	36·82	35·29
11 × 8		56·94	53·77	50·94	48·40	46·09	44·00	42·08	40·33
11 × 9		64·05	60·50	57·31	54·45	51·85	49·50	47·34	45·37
11 × 10		71·17	67·22	63·68	60·50	57·61	55·00	52·60	50·41
11 × 11		78·29	73·94	70·05	66·55	63·38	60·50	57·86	55·45
11 × 11 $\frac{1}{2}$		81·85	77·30	73·23	69·57	66·26	63·25	60·50	57·97
11 × 12		85·41	80·66	76·42	72·60	69·14	66·00	63·13	60·50
11 × 13		92·52	87·38	82·78	78·65	74·90	71·50	68·39	65·54
11 × 14		99·64	94·11	89·15	84·70	80·66	77·00	73·65	70·58
11 × 15		106·76	100·83	95·52	90·75	86·42	82·50	78·91	75·62

Deflection in inches of Red Pine 11 inches deep, loaded with the weights in this table.

Weight uniformly loaded	·432	·484	·539	·598	·659	·723	·790	·861
Wt. suspended from the middle	·691	·774	·863	·956	1·054	1·157	1·265	1·377

\* \* For Scantlings  $11\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{5}{8} \times \frac{2}{4} = 1·093$ , and the deflections by  $\frac{2}{3} = ·956$ .†

\* Example 1.—Red Pine 11 in. by 7 in., 19 feet long, with 44·57 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·539 of an inch; and with 44·57 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is ·863 of an inch.

† Example 2.—Red Pine  $11\frac{1}{2}$  in. by 7 in., 19 feet long, with  $44·57 \times 1·093 = 48·71$  cwt. uniformly loaded (one-eighth the breaking weight) deflects  $·539 \times ·956 = ·515$  of an inch; and with 48·71 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is  $·863 \times ·956 = ·825$  of an inch.



TABLE XII.

SCANTLINGS, 12 IN. AND  $12\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
12 × 2		288·00	144·00	96·00	72·00	57·60	48·00	41·14	36·00
12 × 2 $\frac{1}{4}$		324·00	162·00	108·00	81·00	64·80	54·00	46·28	40·50
12 × 2 $\frac{1}{2}$		360·00	180·00	120·00	90·00	72·00	60·00	51·42	45·00
12 × 3		432·00	216·00	144·00	108·00	86·40	72·00	61·71	54·00
12 × 3 $\frac{1}{2}$		504·00	252·00	168·00	126·00	100·80	84·00	72·00	63·00
12 × 4		576·00	288·00	192·00	144·00	115·20	96·00	82·28	72·00
12 × 4 $\frac{1}{2}$		648·00	324·00	216·00	162·00	129·60	108·00	92·57	81·00
12 × 5		720·00	360·00	240·00	180·00	144·00	120·00	102·85	90·00
12 × 5 $\frac{1}{2}$		792·00	396·00	264·00	198·00	158·40	132·00	113·14	99·00
12 × 6		864·00	432·00	288·00	216·00	172·80	144·00	123·42	108·00
12 × 7		1008·00	504·00	336·00	252·00	201·60	168·00	144·00	126·00
* 12 × 8		1152·00	576·00	384·00	288·00	230·40	192·00	164·57	144·00
12 × 9		1296·00	648·00	432·00	324·00	259·20	216·00	185·14	162·00
12 × 10		1440·00	720·00	480·00	360·00	288·00	240·00	205·71	180·00
12 × 11		1584·00	792·00	528·00	396·00	316·80	264·00	226·28	198·00
12 × 12		1728·00	864·00	576·00	432·00	345·60	288·00	246·85	216·00
12 × 12 $\frac{1}{2}$		1800·00	900·00	600·00	450·00	360·00	300·00	257·14	225·00
12 × 13		1872·00	936·00	624·00	468·00	374·40	312·00	267·42	234·00
12 × 14		2016·00	1008·00	672·00	504·00	403·20	336·00	288·00	252·00
12 × 15		2160·00	1080·00	720·00	540·00	432·00	360·00	308·57	270·00
Deflection in inches of Red Pine 12 inches deep, loaded with the weights in this table.									
Weight uniformly loaded		·001	·005	·012	·022	·034	·049	·067	·088
Wt. suspended from the middle		·002	·009	·020	·035	·055	·079	·107	·140

\* \* For Scantlings  $12\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{6 \cdot 2 \cdot 5}{3 \cdot 7 \cdot 6} = 1.08507$ , and the deflections by  $\frac{2 \cdot 4}{3} = .96$ .†

\* Example 1.—Red Pine 12 in. by 8 in., 8 feet long, with 144 cwt. uniformly loaded, (one-eighth the breaking weight) deflects .088 of an inch; and with 144 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is .140 of an inch.

† Example 2.—Red Pine  $12\frac{1}{2}$  in. by 8 in., 8 feet long, with  $144 \times 1.085 = 156.25$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $.088 \times .96 = .084$  of an inch; and with 156.25 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $.14 \times .96 = .134$  of an inch.

TABLE XII. *Continued.*SCANTLINGS, 12 IN. AND  $12\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
12 × 2		32·00	28·80	26·18	24·00	22·15	20·57	19·20	18·00
12 × 2¼		36·00	32·40	29·45	27·00	24·92	23·14	21·60	20·25
12 × 2½		40·00	36·00	32·72	30·00	27·69	25·71	24·00	22·50
12 × 3		48·00	43·20	39·27	36·00	33·23	30·85	28·80	27·00
12 × 3½		56·00	50·40	45·81	42·00	38·76	36·00	33·60	31·50
12 × 4		64·00	57·60	52·36	48·00	44·30	41·14	38·40	36·00
12 × 4½		72·00	64·80	58·90	54·00	49·84	46·28	43·20	40·50
12 × 5		80·00	72·00	65·45	60·00	55·38	51·42	48·00	45·00
12 × 5½		88·00	79·20	72·00	66·00	60·92	56·57	52·80	49·50
12 × 6		96·00	86·40	78·54	72·00	66·46	61·71	57·60	54·00
12 × 7		112·00	100·80	91·63	84·00	77·53	72·00	67·20	63·00
* 12 × 8		128·00	115·20	104·72	96·00	88·61	82·28	76·80	72·00
12 × 9		144·00	129·60	117·81	108·00	99·69	92·57	86·40	81·00
12 × 10		160·00	144·00	130·90	120·00	110·76	102·85	96·00	90·00
12 × 11		176·00	158·40	144·00	132·00	121·84	113·14	105·60	99·00
12 × 12		192·00	172·80	157·09	144·00	132·92	123·42	115·20	108·00
12 × 12½		200·00	180·00	163·63	150·00	138·46	128·57	120·00	112·50
12 × 13		208·00	187·20	170·18	156·00	144·00	133·71	124·80	117·00
12 × 14		224·00	201·60	183·27	168·00	155·07	144·00	134·40	126·00
12 × 15		240·00	216·00	196·36	180·00	166·15	154·28	144·00	135·00

Deflection in inches of Red Pine 12 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded	·111	·137	·166	·197	·231	·268	·308	·351
Wt. suspended from the middle	·178	·219	·265	·316	·370	·430	·493	·561

\*\* For Scantlings  $12\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{625}{576} = 1·08507$ , and the deflections by  $\frac{4}{3} = ·96$ .†

\* Example 1.—Red Pine 12 in. by 8 in., 12 feet long, with 96 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·197 of an inch; and with 96 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·316 of an inch.

†\* Example 2.—Red Pine  $12\frac{1}{2}$  in. by 8 in., 12 feet long, with  $96 \times 1·085 = 104·16$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·197 \times ·96 = ·189$  of an inch; and with 104·16 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·316 \times ·96 = ·303$  of an inch.

TABLE XII. *Continued.*SCANTLINGS, 12 IN. AND  $12\frac{1}{2}$  INCHES DEEP.

The Weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	17	18	19	20	21	22	23	24
Depth. Breadth.	WEIGHT IN CWTs.							
12 × 2	16·94	16·00	15·15	14·40	13·71	13·09	12·52	12·00
12 × $2\frac{1}{2}$	19·05	18·00	17·05	16·20	15·42	14·72	14·08	13·50
12 × $2\frac{3}{4}$	21·17	20·00	18·94	18·00	17·14	16·36	15·65	15·00
12 × 3	25·41	24·00	22·73	21·60	20·57	19·63	18·78	18·00
12 × $3\frac{1}{2}$	29·64	28·00	26·52	25·20	24·00	22·90	21·91	21·00
12 × 4	33·88	32·00	30·31	28·80	27·42	26·18	25·04	24·00
12 × $4\frac{1}{2}$	38·11	36·00	34·10	32·40	30·85	29·45	28·17	27·00
12 × 5	42·35	40·00	37·89	36·00	34·28	32·72	31·30	30·00
12 × $5\frac{1}{2}$	46·58	44·00	41·68	39·60	37·71	36·00	34·43	33·00
12 × 6	50·82	48·00	45·47	43·20	41·14	39·27	37·56	36·00
12 × 7	59·29	56·00	53·05	50·40	48·00	45·81	43·82	42·00
* 12 × 8	67·76	64·00	60·63	57·60	54·85	52·36	50·08	48·00
12 × 9	76·23	72·00	68·21	64·80	61·71	58·90	56·34	54·00
12 × 10	84·70	80·00	75·78	72·00	68·57	65·45	62·60	60·00
12 × 11	93·17	88·00	83·36	79·20	75·42	72·00	68·86	66·00
12 × 12	101·64	96·00	90·94	86·40	82·28	78·54	75·13	72·00
12 × $12\frac{1}{2}$	105·88	100·00	94·73	90·00	85·71	81·81	78·26	75·00
12 × 13	110·11	104·00	98·52	93·60	89·14	85·09	81·39	78·00
12 × 14	118·58	112·00	106·10	100·80	96·00	91·63	87·65	84·00
12 × 15	127·05	120·00	113·68	108·00	102·85	98·18	93·91	90·00

Deflection in inches of Red Pine 12 inches deep, loaded with the weights in this table.

Weight uniform. ly loaded.	·396	·444	·494	·548	·604	·663	·725	·789
Wt. suspended from the middle.	·633	·710	·791	·877	·966	1·061	1·159	1·262

\* \* \* For Scantlings  $12\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{62\frac{5}{6}}{57\frac{5}{6}} = 1·08507$ , and the deflections by  $\frac{2\frac{1}{2}}{2\frac{1}{2}} = ·96$ .

\* Example 1.—Red Pine 12 in. by 8 in., 20 feet long, with 57·60 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·548 of an inch; and with 57·60 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·877 of an inch.

\* Example 2.—Red Pine  $12\frac{1}{2}$  in. by 8 in., 20 feet long, with  $57·6 \times 1·085 = 62·50$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·548 \times ·96 = ·526$  of an inch; and with 62·50 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·877 \times ·96 = ·842$  of an inch.



TABLE XIII.

SCANTLINGS, 13 IN. AND  $13\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
 ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
13 × 2		338·00	169·00	112·66	84·50	67·60	56·33	48·28	42·25
13 × $2\frac{1}{2}$		422·50	211·25	140·83	105·62	84·50	70·41	60·35	52·81
13 × 3		507·00	253·50	169·00	126·75	101·40	84·50	72·42	63·37
13 × $3\frac{1}{2}$		591·50	295·75	197·16	147·87	118·30	98·58	84·50	73·93
13 × 4		676·00	338·00	225·33	169·00	135·20	112·66	96·57	84·50
13 × $4\frac{1}{2}$		760·50	380·25	253·50	190·12	152·10	126·75	108·64	95·06
13 × 5		845·00	422·50	281·66	211·25	169·00	140·83	120·71	105·62
13 × $5\frac{1}{2}$		929·50	464·75	309·83	232·37	185·90	154·91	132·78	116·18
13 × 6		1014·00	507·00	338·00	253·50	202·80	169·00	144·85	126·75
13 × $6\frac{1}{2}$		1098·50	549·25	366·16	274·62	219·70	183·08	156·92	137·31
13 × 7		1183·00	591·50	394·33	295·75	236·60	197·16	169·00	147·87
13 × 8		1352·00	676·00	450·66	338·00	270·40	225·33	193·14	169·00
* 13 × 9		1521·00	760·50	507·00	380·25	304·20	253·50	217·28	190·12
13 × 10		1690·00	845·00	563·33	422·50	338·00	281·66	241·42	211·25
13 × 11		1859·00	929·50	619·66	464·75	371·80	309·83	265·57	232·37
13 × 12		2028·00	1014·00	676·00	507·00	405·60	338·00	289·71	253·50
13 × 13		2197·00	1098·50	732·33	549·25	439·40	366·16	313·85	274·62
13 × $13\frac{1}{2}$		2281·50	1140·75	760·50	570·37	456·30	380·25	325·92	285·18
13 × 14		2366·00	1183·00	788·66	591·50	473·20	394·33	338·00	295·75
13 × 15		2535·00	1267·50	845·00	633·75	507·00	422·50	362·14	316·87

Deflection in inches of Red Pine 13 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·001	·005	·011	·020	·032	·046	·062	·081
Wt. suspended from the middle.	·002	·008	·018	·032	·051	·073	·099	·129

\* \* For Scantlings  $13\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{7}{6} = 1·0784$ , and the deflections by  $\frac{2}{3} = ·6667$ .

\* Example 1.—Red Pine 13 in. by 9 in., 5 feet long, with 304·20 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·032 of an inch; and with 304·20 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·051 of an inch.

\* Example 2.—Red Pine  $13\frac{1}{2}$  in. by 9 in., 5 feet long, with  $304·2 \times 1·0784 = 328·05$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·032 \times ·963 = ·031$  of an inch; and with 328·05 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·051 \times ·963 = ·049$  of an inch.



TABLE XIII. *Continued.*SCANTLINGS, 13 IN. AND  $13\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
	13 × 2	37·55	33·80	30·72	28·16	26·00	24·14	22·53	21·12
	13 × $2\frac{1}{2}$	46·94	42·25	38·40	35·20	32·50	30·17	28·16	26·40
	13 × 3	56·33	50·70	46·09	42·25	39·00	36·21	33·80	31·68
	13 × $3\frac{1}{2}$	65·72	59·15	53·77	49·29	45·50	42·25	39·43	36·96
	13 × 4	75·11	67·60	61·45	56·33	52·00	48·28	45·06	42·25
	13 × $4\frac{1}{2}$	84·50	76·05	69·13	63·37	58·50	54·32	50·70	47·53
	13 × 5	93·88	84·50	76·81	70·41	65·00	60·35	56·33	52·81
	13 × $5\frac{1}{2}$	103·27	92·95	84·50	77·45	71·50	66·39	61·96	58·09
	13 × 6	112·66	101·40	92·18	84·50	78·00	72·42	67·60	63·37
	13 × $6\frac{1}{2}$	122·05	109·85	99·86	91·54	84·50	78·46	73·23	68·65
	13 × 7	131·44	118·30	107·54	98·58	91·00	84·50	78·86	73·93
	13 × 8	150·22	135·20	122·90	112·66	104·00	96·57	90·13	84·50
*	13 × 9	169·00	152·10	138·27	126·75	117·00	108·64	101·40	95·06
	13 × 10	187·77	169·00	153·63	140·83	130·00	120·71	112·66	105·62
	13 × 11	206·55	185·90	169·00	154·91	143·00	132·78	123·93	116·18
	13 × 12	225·33	202·80	184·36	169·00	156·00	144·85	135·20	126·75
	13 × 13	244·11	219·70	199·72	183·08	169·00	156·92	146·46	137·31
	13 × $13\frac{1}{2}$	253·50	228·15	207·40	190·12	175·50	162·96	152·10	142·59
	13 × 14	262·88	236·60	215·09	197·16	182·00	169·00	157·73	147·87
	13 × 15	281·66	253·50	230·45	211·25	195·00	181·07	169·00	158·43

Deflection in inches of Red Pine 13 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·102	·126	·153	·182	·214	·248	·284	·324
Wt. suspended from the middle.	·164	·202	·245	·291	·342	·396	·455	·518

\* \* For Scantlings  $13\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{7\frac{2}{3}}{6\frac{2}{3}} = 1·0784$ , and the deflections by  $\frac{2\frac{6}{7}}{2\frac{7}{7}} = ·963$ .†

\* Example 1.—Red Pine 13 in. by 9 in., 13 feet long, with 117 cwts. uniformly loaded, (one-eighth the breaking weight) deflects ·214 of an inch; and with 117 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is ·342 of an inch.

† Example 2.—Red Pine  $13\frac{1}{2}$  in. by 9 in., 13 feet long, with  $117 \times 1·0784 = 126·17$  cwts. uniformly loaded, (one-eighth the breaking weight) deflects  $·214 \times ·963 = ·206$  of an inch; and with 126·17 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·342 \times ·963 = ·329$  of an inch.

TABLE XIII. *Continued.*SCANTLINGS, 13 IN. AND  $13\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
13 × 2		19·88	18·77	17·78	16·90	16·09	15·36	14·69	14·08
13 × $2\frac{1}{2}$		24·85	23·47	22·23	21·12	20·11	19·20	18·36	17·60
13 × 3		29·82	28·16	26·68	25·35	24·14	23·04	22·04	21·12
13 × $3\frac{1}{2}$		34·79	32·86	31·13	29·57	28·16	26·88	25·71	24·64
13 × 4		39·76	37·55	35·57	33·80	32·19	30·72	29·39	28·16
13 × $4\frac{1}{2}$		44·73	42·25	40·02	38·02	36·21	34·56	33·06	31·68
13 × 5		49·70	46·94	44·47	42·25	40·23	38·40	36·73	35·20
13 × $5\frac{1}{2}$		54·67	51·63	48·92	46·47	44·26	42·25	40·41	38·72
13 × 6		59·64	56·33	53·36	50·70	48·28	46·09	44·08	42·25
13 × $6\frac{1}{2}$		64·61	61·02	57·81	54·92	52·30	49·93	47·76	45·77
13 × 7		69·58	65·72	62·26	59·15	56·33	53·77	51·43	49·29
13 × 8		79·52	75·11	71·15	67·60	64·38	61·45	58·78	56·33
* 13 × 9		89·47	84·50	80·05	76·05	72·42	69·13	66·13	63·37
13 × 10		99·41	93·88	88·94	84·50	80·47	76·81	73·47	70·41
13 × 11		109·35	103·27	97·84	92·95	88·52	84·50	80·82	77·45
13 × 12		119·29	112·66	106·73	101·40	96·57	92·18	88·17	84·50
13 × 13		129·23	122·05	115·63	109·85	104·61	99·86	95·52	91·54
13 × $13\frac{1}{2}$		134·20	126·75	120·07	114·07	108·64	103·70	99·19	95·06
13 × 14		139·17	131·44	124·52	118·30	112·66	107·54	102·86	98·58
13 × 15		149·11	140·83	133·42	126·75	120·71	115·22	110·21	105·62

Deflection in inches of Red Pine 13 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·365	·410	·456	·506	·558	·612	·669	·728
Wt. suspended from the middle.	·585	·655	·730	·809	·892	·979	1·070	1·165

\* \* \* For Scantlings  $13\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{72}{676} = 1·0784$ , and the deflections by  $\frac{26}{27} = ·963$ .†

\* *Example 1.*—Red Pine 13 in. by 9 in., 21 feet long, with 72·42 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·558 of an inch; and with 72·42 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·892 of an inch.

† \* *Example 2.*—Red Pine,  $13\frac{1}{2}$  in. by 9 in., 21 feet long, with  $72·42 \times 1·0784 = 78·10$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·558 \times ·963 = ·537$  of an inch; and with 78·10 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·892 \times ·963 = ·859$  of an inch.

TABLE XIII. *Continued.*SCANTLINGS, 13 IN. AND  $13\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		25	26	27	28	29	30	31	32
Depth.	Breadth.	WEIGHT IN CWTs.							
13 × 2		13·52	13·00	12·51	12·07	11·65	11·26	10·90	10·56
13 × $2\frac{1}{2}$		16·90	16·25	15·64	15·08	14·56	14·08	13·62	13·20
13 × 3		20·28	19·50	18·77	18·10	17·48	16·90	16·35	15·84
13 × $3\frac{1}{2}$		23·66	22·75	21·90	21·12	20·39	19·71	19·08	18·48
13 × 4		27·04	26·00	25·03	24·14	23·31	22·53	21·80	21·12
13 × $4\frac{1}{2}$		30·42	29·25	28·16	27·16	26·22	25·35	24·53	23·76
13 × 5		33·80	32·50	31·29	30·17	29·13	28·16	27·25	26·40
13 × $5\frac{1}{2}$		37·18	35·75	34·42	33·19	32·05	30·98	29·98	29·04
13 × 6		40·56	39·00	37·55	36·21	34·96	33·80	32·70	31·68
13 × $6\frac{1}{2}$		43·94	42·25	40·68	39·23	37·87	36·61	35·43	34·32
13 × 7		47·32	45·50	43·81	42·25	40·79	39·43	38·16	36·96
13 × 8		54·08	52·00	50·07	48·28	46·62	45·06	43·61	42·25
* 13 × 9		60·84	58·50	56·33	54·32	52·44	50·70	49·06	47·53
13 × 10		67·60	65·00	62·59	60·35	58·27	56·33	54·51	52·81
13 × 11		74·36	71·50	68·85	66·39	64·10	61·96	59·96	58·09
13 × 12		81·12	78·00	75·11	72·42	69·93	67·60	65·41	63·37
13 × 13		87·88	84·50	81·37	78·46	75·75	73·23	70·87	68·65
13 × $13\frac{1}{2}$		91·26	87·75	84·50	81·48	78·67	76·05	73·59	71·29
13 × 14		94·64	91·00	87·62	84·50	81·58	78·86	76·32	73·93
13 × 15		101·40	97·50	93·88	90·53	87·41	84·50	81·77	79·21

Deflection in inches of Red Pine 13 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·790	·855	·922	·991	1·063	1·138	1·215	1·295
Wt. suspended from the middle.	1·264	1·367	1·475	1·586	1·701	1·820	1·944	2·071

\* \* \* For Scantlings  $13\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{729}{676} = 1·0784$ , and the deflections by  $\frac{25}{27} = ·963$ .†

\* Example 1.—Red Pine 13 in. by 9 in., 25 feet long, with 60·84 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·790 of an inch; and with 60·84 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is 1·264 inches.

† Example 2.—Red Pine  $13\frac{1}{2}$  in. by 9 in., 25 feet long, with  $60·84 \times 1·0784 = 65·61$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·79 \times ·963 = ·761$  of an inch; and with 65·61 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·264 \times ·963 = 1·217$  inches.



## TABLE XIV.

## SCANTLINGS, 14 IN. AND 14½ INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
14 × 2		392·00	196·00	130·66	98·00	78·40	65·33	56·00	49·00
14 × 2½		490·00	245·00	163·33	122·50	98·00	81·66	70·00	61·25
14 × 3		588·00	294·00	196·00	147·00	117·60	98·00	84·00	73·50
14 × 3½		686·00	343·00	228·66	171·50	137·20	114·33	98·00	85·75
14 × 4		784·00	392·00	261·33	196·00	156·80	130·66	112·00	98·00
14 × 4½		882·00	441·00	294·00	220·50	176·40	147·00	126·00	110·25
14 × 5		980·00	490·00	326·66	245·00	196·00	163·33	140·00	122·50
14 × 5½		1078·00	539·00	359·33	269·50	215·60	179·66	154·00	134·75
14 × 6		1176·00	588·00	392·00	294·00	235·20	196·00	168·00	147·00
14 × 6½		1274·00	637·00	424·66	318·50	254·80	212·33	182·00	159·25
14 × 7		1372·00	686·00	457·33	343·00	274·40	228·66	196·00	171·50
14 × 8		1568·00	784·00	522·66	392·00	313·60	261·33	224·00	196·00
14 × 9		1764·00	882·00	588·00	441·00	352·80	294·00	252·00	220·50
* 14 × 10		1960·00	980·00	653·33	490·00	392·00	326·66	280·00	245·00
14 × 11		2156·00	1078·00	718·66	539·00	431·20	359·33	308·00	269·50
14 × 12		2352·00	1176·00	784·00	588·00	470·40	392·00	336·00	294·00
14 × 13		2548·00	1274·00	849·33	637·00	509·60	424·66	364·00	318·50
14 × 14		2744·00	1372·00	914·66	686·00	548·80	457·33	392·00	343·00
14 × 14½		2842·00	1421·00	947·33	710·50	568·40	473·66	406·00	355·25
14 × 15		2940·00	1470·00	980·00	735·00	588·00	490·00	420·00	367·50

Deflection in inches of Red Pine 14 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·001	·005	·011	·019	·029	·042	·058	·075
Wts. suspended from the middle.	·002	·008	·017	·030	·047	·068	·092	·120

\* \* For Scantlings 14½ inches deep, multiply the weights in this table by  $\frac{8\frac{1}{2}}{7\frac{3}{4}} = 1·0727$ , and the deflections by  $\frac{2\frac{3}{2}}{2\frac{1}{2}} = ·965$ .†

\* Example 1.—Red Pine 14 in. by 10 in., 6 feet long, with 326·66 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·042 of an inch; and with 326·66 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·068 of an inch.

† Example 2.—Red Pine 14½ in. by 10 in., 6 feet long, with  $326·66 \times 1·0727 = 350·41$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·042 \times ·965 = ·041$  of an inch; and with 350·41 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·068 \times ·965 = ·066$  of an inch.



TABLE XIV. *Continued.*SCANTLINGS, 14 IN. AND  $14\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET CLEAR BEARING.						
		9	10	11	12	13	14	15
Depth. Breadth		WEIGHT IN CWTs.						
		14 × 2	14 × 2½	14 × 3	14 × 3½	14 × 4	14 × 4½	14 × 5
		43·55	54·44	65·33	76·22	87·11	98·00	108·88
		39·20	49·00	58·80	68·60	78·40	88·20	98·00
		35·63	44·54	53·45	62·36	71·27	80·18	89·09
		32·66	40·83	49·00	57·16	65·33	73·50	81·66
		30·15	37·69	45·23	52·76	60·30	67·84	75·38
		28·00	35·00	42·00	49·00	56·00	63·00	70·00
		26·13	32·66	39·20	45·73	52·26	58·80	65·33
		24·50	30·62	36·75	42·87	49·00	55·12	61·25
		22·87	28·99	35·12	41·25	47·38	53·50	59·63
		21·25	27·37	33·50	39·63	45·75	51·88	58·00
		19·63	25·75	31·88	38·00	44·13	50·25	56·38
		18·00	24·13	30·25	36·38	42·50	48·63	54·75
		16·38	22·50	28·63	34·75	40·88	47·00	53·13
		14·75	20·88	27·00	33·13	39·25	45·38	51·50
		13·13	19·25	25·38	31·50	37·63	43·75	49·88
		11·50	17·63	23·75	29·88	36·00	42·13	48·25
		9·88	15·00	21·13	27·25	33·38	39·50	45·63
		8·25	13·38	19·50	25·63	31·75	37·88	44·00
		6·63	11·75	17·88	24·00	30·13	36·25	42·38
		5·00	10·13	16·25	22·38	28·50	34·63	40·75
		3·38	8·50	14·63	20·75	26·88	33·00	39·13
		1·75	6·88	13·00	19·13	25·25	31·38	37·50
		0·13	5·25	11·38	17·50	23·63	29·75	35·88

Deflection in inches of Red Pine 14 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·095	·117	·142	·169	·198	·230	·264	·301
Wt. suspended from the middle.	·152	·188	·227	·270	·317	·368	·423	·481

\* \* \* For Scantlings  $14\frac{1}{2}$  inches deep, multiply the weights in this table  
by  $\frac{8\frac{1}{4}}{7\frac{3}{4}} = 1·0727$ , and the deflections by  $\frac{2\frac{8}{9}}{2\frac{8}{9}} = ·965$ .†

\* Example 1.—Red Pine 14 in. by 10 in., 14 feet long, with 140 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·230 of an inch; and with 140 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·368 of an inch.

† Example 2.—Red Pine  $14\frac{1}{2}$  in. by 10 in., 14 feet long, with  $140 \times 1·0727 = 150·17$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·23 \times ·965 = ·222$  of an inch; and with 150·17 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·368 \times ·965 = ·355$  of an inch.

TABLE XIV. *Continued.*SCANTLINGS, 14 IN. AND  $14\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
14 X 2		23·05	21·77	20·63	19·60	18·66	17·81	17·04	16·33
14 X $2\frac{1}{2}$		28·82	27·22	25·78	24·50	23·33	22·27	21·30	20·41
14 X 3		34·58	32·66	30·94	29·40	28·00	26·72	25·56	24·50
14 X $3\frac{1}{2}$		40·35	38·11	36·10	34·30	32·66	31·18	29·82	28·58
14 X 4		46·11	43·55	41·26	39·20	37·33	35·63	34·08	32·66
14 X $4\frac{1}{2}$		51·88	49·00	46·42	44·10	42·00	40·09	38·34	36·75
14 X 5		57·64	54·44	51·57	49·00	46·66	44·54	42·60	40·83
14 X $5\frac{1}{2}$		63·41	59·88	56·73	53·90	51·33	49·00	46·86	44·91
14 X 6		69·17	65·33	61·89	58·80	56·00	53·45	51·13	49·00
14 X $6\frac{1}{2}$		74·94	70·77	67·05	63·70	60·66	57·90	55·39	53·08
14 X 7		80·70	76·22	72·21	68·60	65·33	62·36	59·65	57·16
14 X 8		92·23	87·11	82·52	78·40	74·66	71·27	68·17	65·33
14 X 9		103·76	98·00	92·84	88·20	84·00	80·18	76·69	73·50
* 14 X 10		115·29	108·88	103·15	98·00	93·33	89·09	85·21	81·66
14 X 11		126·82	119·77	113·47	107·80	102·66	98·00	93·73	89·83
14 X 12		138·35	130·66	123·78	117·60	112·00	106·90	102·26	98·00
14 X 13		149·88	141·55	134·10	127·40	121·33	115·81	110·78	106·16
14 X 14		161·41	152·44	144·42	137·20	130·66	124·72	119·30	114·33
14 X $14\frac{1}{2}$		167·17	157·88	149·57	142·10	135·33	129·18	123·56	118·41
14 X 15		172·94	163·33	154·73	147·00	140·00	133·63	127·82	122·50

Deflection in inches of Red Pine 14 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·339	·380	·424	·470	·518	·568	·621	·676
Wt. suspended from the middle.	·543	·609	·678	·751	·828	·909	·994	1·082

\* \* \* For Scantlings  $14\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{8\frac{1}{2}}{7\frac{3}{4}} = 1·0727$ , and the deflections by  $\frac{2\frac{2}{3}}{2\frac{1}{2}} = ·965$ .†

\* Example 1.—Red Pine 14 in. by 10 in., 22 feet long, with 89·09 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·568 of an inch; and with 89·09 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·909 of an inch.

† Example 2.—Red Pine  $14\frac{1}{2}$  in. by 10 in., 22 feet long, with  $89·09 \times 1·0727 = 95·56$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·568 \times ·965 = ·548$  of an inch; and with  $95·56$  cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·909 \times ·965 = ·877$  of an inch.

TABLE XIV. *Continued.*SCANTLINGS, 14 IN. AND  $14\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		25	26	27	28	29	30	31	32
Depth.	Breadth.	WEIGHT IN CWTs.							
14 × 2		15·68	15·07	14·51	14·00	13·51	13·06	12·64	12·25
14 × 2½		19·60	18·84	18·14	17·50	16·89	16·33	15·80	15·31
14 × 3		23·52	22·61	21·77	21·00	20·27	19·60	18·96	18·37
14 × 3½		27·44	26·38	25·40	24·50	23·65	22·86	22·12	21·43
14 × 4		31·36	30·15	29·03	28·00	27·03	26·13	25·29	24·50
14 × 4½		35·28	33·92	32·66	31·50	30·41	29·40	28·45	27·56
14 × 5		39·20	37·69	36·29	35·00	33·79	32·66	31·61	30·62
14 × 5½		43·12	41·46	39·92	38·50	37·17	35·93	34·77	33·68
14 × 6		47·04	45·23	43·55	42·00	40·55	39·20	37·93	36·75
14 × 6½		50·96	49·00	47·18	45·50	43·93	42·46	41·09	39·81
14 × 7		54·88	52·76	50·81	49·00	47·31	45·73	44·25	42·87
14 × 8		62·72	60·30	58·07	56·00	54·06	52·26	50·58	49·00
14 × 9		70·56	67·84	65·33	63·00	60·82	58·80	56·90	55·12
* 14 × 10		78·40	75·38	72·59	70·00	67·58	65·33	63·22	61·25
14 × 11		86·24	82·92	79·85	77·00	74·34	71·86	69·54	67·37
14 × 12		94·08	90·46	87·11	84·00	81·10	78·40	75·87	73·50
14 × 13		101·92	98·00	94·37	91·00	87·86	84·93	82·19	79·62
14 × 14		109·76	105·53	101·62	98·00	94·62	91·46	88·51	85·75
14 × 14½		113·68	109·30	105·25	101·50	98·00	94·73	91·67	88·81
14 × 15		117·60	113·07	108·88	105·00	101·37	98·00	94·83	91·87

Deflection in inches of Red Pine 14 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·734	·794	·856	·920	·987	1·057	1·128	1·202
Wt. suspended from the middle.	1·174	1·270	1·369	1·473	1·580	1·690	1·805	1·923

\* \* \* For Scantlings  $14\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{8+1}{8+4}=1·0727$ , and the deflections by  $\frac{2·8}{2·9}=.965$ .†

\* Example 1.—Red Pine 14 in. by 10 in., 26 feet long, with 75·38 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·794 of an inch; and with 75·38 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is 1·270 inches.

† Example 2.—Red Pine  $14\frac{1}{2}$  in. by 10 in., 26 feet long, with  $75·38 \times 1·0727 = 80·86$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·794 \times .965 = .766$  of an inch; and with 80·86 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·27 \times .965 = 1·226$  inches.



## TABLE XV.

SCANTLINGS, 15 IN. AND  $15\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		1	2	3	4	5	6	7	8
Depth.	Breadth.	WEIGHT IN CWTs.							
15 × 2		450·00	225·00	150·00	112·50	90·00	75·00	64·28	56·25
15 × $2\frac{1}{2}$		562·50	281·25	187·50	140·62	112·50	93·75	80·35	70·31
15 × 3		675·00	337·50	225·00	168·75	135·00	112·50	96·42	84·37
15 × $3\frac{1}{2}$		787·50	393·75	262·50	196·87	157·50	131·25	112·50	98·43
15 × 4		900·00	450·00	300·00	225·00	180·00	150·00	128·57	112·50
15 × $4\frac{1}{2}$		1012·50	506·25	337·50	253·12	202·50	168·75	144·64	126·56
15 × 5		1125·00	562·50	375·00	281·25	225·00	187·50	160·71	140·62
15 × $5\frac{1}{2}$		1237·50	618·75	412·50	309·37	247·50	206·25	176·78	154·68
15 × 6		1350·00	675·00	450·00	337·50	270·00	225·00	192·85	168·75
15 × $6\frac{1}{2}$		1462·50	731·25	487·50	365·62	292·50	243·75	208·92	182·81
15 × 7		1575·00	787·50	525·00	393·75	315·00	262·50	225·00	196·87
15 × 8		1800·00	900·00	600·00	450·00	360·00	300·00	257·14	225·00
15 × 9		2025·00	1012·50	675·00	506·25	405·00	337·50	289·28	253·12
15 × 10		2250·00	1125·00	750·00	562·50	450·00	375·00	321·42	281·25
* 15 × 11		2475·00	1237·50	825·00	618·75	495·00	412·50	353·57	309·37
15 × 12		2700·00	1350·00	900·00	675·00	540·00	450·00	385·71	337·50
15 × 13		2925·00	1462·50	975·00	731·25	585·00	487·50	417·85	365·62
15 × 14		3150·00	1575·00	1050·00	787·50	630·00	525·00	450·00	393·75
15 × 15		3375·00	1687·50	1125·00	843·75	675·00	562·50	482·14	421·87
15 × $15\frac{1}{2}$		3487·50	1743·75	1162·50	871·87	697·50	581·25	498·21	435·93
Deflection in inches of Red Pine 15 inches deep, loaded with the weights in this table.									
Weight uniformly loaded.		·001	·004	·010	·018	·027	·039	·054	·070
Wt. suspended from the middle.		·002	·007	·016	·028	·044	·063	·086	·112

\* \* \* For Scantlings  $15\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{261}{375} = 1·0677$ , and the deflections by  $\frac{30}{375} = ·08$ .

\* Example 1.—Red Pine 15 in. by 11 in., 7 feet long, with 353·57 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·054 of an inch; and with 353·43 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·086 of an inch.

\* Example 2.—Red Pine  $15\frac{1}{2}$  in. by 11 in., 7 feet long, with  $353·57 \times 1·0677 = 377·53$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·054 \times ·968 = ·052$  of an inch; and with 377·53 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·086 \times ·968 = ·083$  of an inch.



TABLE XV. *Continued.*SCANTLINGS, 15 IN. AND  $15\frac{1}{2}$  INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		9	10	11	12	13	14	15	16
Depth.	Breadth.	WEIGHT IN CWTs.							
15 X 2		50·00	45·00	40·90	37·50	34·61	32·14	30·00	28·12
15 X 2½		62·50	56·25	51·13	46·87	43·26	40·17	37·50	35·15
15 X 3		75·00	67·50	61·36	56·25	51·92	48·21	45·00	42·18
15 X 3½		87·50	78·75	71·59	65·62	60·57	56·25	52·50	49·21
15 X 4		100·00	90·00	81·81	75·00	69·23	64·28	60·00	56·25
15 X 4½		112·50	101·25	92·04	84·37	77·88	72·32	67·50	63·28
15 X 5		125·00	112·50	102·27	93·75	86·53	80·35	75·00	70·31
15 X 5½		137·50	123·75	112·50	103·12	95·19	88·39	82·50	77·34
15 X 6		150·00	135·00	122·72	112·50	103·84	96·42	90·00	84·37
15 X 6½		162·50	146·25	132·95	121·87	112·50	104·46	97·50	91·40
15 X 7		175·00	157·50	143·18	131·25	121·15	112·50	105·00	98·43
15 X 8		200·00	180·00	163·63	150·00	138·46	128·57	120·00	112·50
15 X 9		225·00	202·50	184·09	168·75	155·76	144·64	135·00	126·56
15 X 10		250·00	225·00	204·54	187·50	173·07	160·71	150·00	140·62
* 15 X 11		275·00	247·50	225·00	206·25	190·38	176·78	165·00	154·68
15 X 12		300·00	270·00	245·45	225·00	207·69	192·85	180·00	168·75
15 X 13		325·00	292·50	265·90	243·75	225·00	208·92	195·00	182·81
15 X 14		350·00	315·00	286·36	262·50	242·30	225·00	210·00	196·87
15 X 15		375·00	337·50	306·81	281·25	259·61	241·07	225·00	210·93
15 X 15½		387·50	348·75	317·04	290·62	268·26	249·10	232·50	217·96

Deflection in inches of Red Pine 15 inches deep, loaded with the weights in this table.

Weight uniform- ly loaded.	·089	·110	·133	·158	·185	·215	·247	·280
Wt. suspended from the middle.	·142	·175	·212	·252	·296	·344	·394	·449

\* \* \* For Scantlings  $15\frac{1}{2}$  inches deep, multiply the weights in this table  
by  $\frac{961}{900} = 1·0677$ , and the deflections by  $\frac{3}{4} = ·968$ .†

\* Example 1.—Red Pine 15 in. by 11 in., 15 feet long, with 165 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·247 of an inch; and with 165 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·394 of an inch.

† Example 2.—Red Pine  $15\frac{1}{2}$  in. by 11 in., 15 feet long, with  $165 \times 1·0677 = 176·18$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·247 \times ·968 = ·239$  of an inch; and with 176·18 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $·394 \times ·968 = ·381$  of an inch.

TABLE XV. *Continued.*SCANTLINGS, 15 IN. AND  $15\frac{1}{2}$  INCHES DEEP.

The Weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	17	18	19	20	21	22	23	24
Depth. Breadth.	WEIGHT IN CWTs.							
15 × 2	26·47	25·00	23·68	22·50	21·42	20·45	19·56	18·75
15 × 2½	33·08	31·25	29·60	28·12	26·78	25·56	24·45	23·43
15 × 3	39·70	37·50	35·52	33·75	32·14	30·68	29·34	28·12
15 × 3½	46·32	43·75	41·44	39·37	37·50	35·79	34·23	32·81
15 × 4	52·94	50·00	47·36	45·00	42·85	40·90	39·13	37·50
15 × 4½	59·55	56·25	53·28	50·62	48·21	46·02	44·02	42·18
15 × 5	66·17	62·50	59·21	56·25	53·57	51·13	48·91	46·87
15 × 5½	72·79	68·75	65·13	61·87	58·92	56·25	53·80	51·56
15 × 6	79·41	75·00	71·05	67·50	64·28	61·36	58·69	56·25
15 × 6½	86·02	81·25	76·97	73·12	69·64	66·47	63·58	60·93
15 × 7	92·64	87·50	82·89	78·75	75·00	71·59	68·47	65·62
15 × 8	105·88	100·00	94·73	90·00	85·71	81·81	78·26	75·00
15 × 9	119·11	112·50	106·57	101·25	96·42	92·04	88·04	84·37
15 × 10	132·35	125·00	118·42	112·50	107·14	102·27	97·82	93·75
* 15 × 11	145·58	137·50	130·26	123·75	117·85	112·50	107·60	103·12
15 × 12	158·82	150·00	142·10	135·00	128·57	122·72	117·39	112·50
15 × 13	172·05	162·50	153·94	146·25	139·28	132·95	127·17	121·87
15 × 14	185·29	175·00	165·78	157·50	150·00	143·18	136·95	131·25
15 × 15	198·52	187·50	177·63	168·75	160·71	153·40	146·73	140·62
15 × 15½	205·14	193·75	183·55	174·37	166·07	158·52	151·63	145·31

Deflection in inches of Red Pine 15 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·317	·355	·396	·438	·483	·530	·580	·631
Wt. suspended from the middle.	·507	·568	·633	·701	·773	·848	·927	1·010

\* \* For Scantlings  $15\frac{1}{2}$  inches deep, multiply the weights in this table by  $\frac{9}{10} = 1·0677$ , and the deflections by  $\frac{3}{4} = ·968$ .†

\* Example 1.—Red Pine 15 in. by 11 in., 23 feet long, with 107·60 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·580 of an inch; and with 107·60 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is ·927 of an inch.

† Example 2.—Red Pine  $15\frac{1}{2}$  in. by 11 in., 23 feet long, with  $107·6 \times 1·0677 = 114·89$  cwt. uniformly loaded (one-eighth the breaking weight) deflects  $·58 \times ·968 = ·561$  of an inch; and with 114·89 cwt. suspended from the middle (one-fourth the breaking weight) the deflection is  $·927 \times ·968 = ·897$  of an inch.

TABLE XV. *Continued.*

## SCANTLINGS, 15 IN. AND 15½ INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	25	26	27	28	29	30	31	32
Depth. Breadth.	WEIGHT IN CWTs.							
15 × 2	18·00	17·30	16·66	16·07	15·51	15·00	14·51	14·06
15 × 2½	22·50	21·63	20·83	20·08	19·39	18·75	18·14	17·57
15 × 3	27·00	25·96	25·00	24·10	23·27	22·50	21·77	21·09
15 × 3½	31·50	30·28	29·16	28·12	27·15	26·25	25·40	24·60
15 × 4	36·00	34·61	33·33	32·14	31·03	30·00	29·03	28·12
15 × 4½	40·50	38·94	37·50	36·16	34·91	33·75	32·66	31·64
15 × 5	45·00	43·26	41·66	40·17	38·79	37·50	36·29	35·15
15 × 5½	49·50	47·59	45·83	44·19	42·67	41·25	39·91	38·67
15 × 6	54·00	51·92	50·00	48·21	46·55	45·00	43·54	42·18
15 × 6½	58·50	56·25	54·16	52·23	50·43	48·75	47·17	45·70
15 × 7	63·00	60·57	58·33	56·25	54·31	52·50	50·80	49·21
15 × 8	72·00	69·23	66·66	64·28	62·06	60·00	58·06	56·25
15 × 9	81·00	77·88	75·00	72·32	69·82	67·50	65·32	63·28
15 × 10	90·00	86·53	83·33	80·35	77·58	75·00	72·58	70·31
* 15 × 11	99·00	95·19	91·66	88·39	85·34	82·50	79·83	77·34
15 × 12	108·00	103·84	100·00	96·42	93·10	90·00	87·09	84·37
15 × 13	117·00	112·50	108·33	104·46	100·86	97·50	94·35	91·40
15 × 14	126·00	121·15	116·66	112·50	108·62	105·00	101·61	98·43
15 × 15	135·00	129·80	125·00	120·53	116·37	112·50	108·87	105·46
15 × 15½	139·50	134·13	129·16	124·55	120·25	116·25	112·50	108·98

Deflection in inches of Red Pine 15 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·685	·741	·799	·859	·921	·986	1·053	1·122
Wt. suspended from the middle.	1·096	1·185	1·278	1·374	1·474	1·578	1·685	1·795

\* \* \* For Scantlings 15½ inches deep, multiply the weights in this table by  $\frac{9}{10} \frac{5}{10} = 1·0677$ , and the deflections by  $\frac{3}{4} \frac{1}{10} = ·968$ .†

\* Example 1.—Red Pine 15 in. by 11 in., 27 feet long, with 91·66 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·799 of an inch; and with 91·66 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is 1·278 inches.

† Example 2.—Red Pine 15½ in. by 11 in., 27 feet long, with  $91·66 \times 1·0677 = 97·87$  cwt. uniformly loaded, (one-eighth the breaking weight) deflects  $·799 \times ·968 = ·773$  of an inch; and with 97·87 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is  $1·278 \times ·968 = 1·237$  inches.



## TABLE XVI.

## SCANTLINGS, 16 IN., 17 IN. AND 18 INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or  
ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	1	2	3	4	5	6	7	8
Depth. Breadth.	WEIGHT IN CWTs.							
16 × 2	512·00	256·00	170·66	128·00	102·40	85·33	73·14	64·00
16 × 2½	640·00	320·00	213·33	160·00	128·00	106·66	91·42	80·00
16 × 3	768·00	384·00	256·00	192·00	153·60	128·00	109·71	96·00
16 × 3½	896·00	448·00	298·66	224·00	179·20	149·33	128·00	112·00
16 × 4	1024·00	512·00	341·33	256·00	204·80	170·66	146·28	128·00
16 × 4½	1152·00	576·00	384·00	288·00	230·40	192·00	164·57	144·00
16 × 5	1280·00	640·00	426·66	320·00	256·00	213·33	182·85	160·00
16 × 5½	1408·00	704·00	469·33	352·00	281·60	234·66	201·14	176·00
16 × 6	1536·00	768·00	512·00	384·00	307·20	256·00	219·42	192·00
16 × 6½	1664·00	832·00	554·66	416·00	332·80	277·33	237·71	208·00
16 × 7	1792·00	896·00	597·33	448·00	358·40	298·66	256·00	224·00
16 × 8	2048·00	1024·00	682·66	512·00	409·60	341·33	292·57	256·00
16 × 9	2304·00	1152·00	768·00	576·00	460·80	384·00	329·14	288·00
16 × 10	2560·00	1280·00	853·33	640·00	512·00	426·66	365·71	320·00
16 × 11	2816·00	1408·00	938·66	704·00	563·20	469·33	402·28	352·00
* 16 × 12	3072·00	1536·00	1024·00	768·00	614·40	512·00	438·85	384·00
16 × 13	3328·00	1664·00	1109·33	832·00	665·60	554·66	475·42	416·00
16 × 14	3584·00	1792·00	1194·66	896·00	716·80	597·33	512·00	448·00
16 × 15	3840·00	1920·00	1280·00	960·00	768·00	640·00	548·57	480·00
16 × 16	4096·00	2048·00	1365·33	1024·00	819·20	682·66	585·14	512·00

Deflection in inches of Red Pine 16 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·001	·004	·009	·016	·026	·037	·050	·066
Wt. suspended from the middle.	·002	·007	·015	·026	·041	·059	·081	·105

\* \* \* For Scantlings 17 inches deep, multiply the weights in this table by  $\frac{2 \cdot 9}{3 \cdot 6} = 1 \cdot 289$ , and the deflections by  $\frac{1 \cdot 6}{1 \cdot 7} = \cdot 941$ .

For Scantlings 18 inches deep, multiply the weights in this table by  $\frac{3 \cdot 1}{4} = 1 \cdot 2656$ , and the deflections by  $\frac{3}{4} = \cdot 888$ .

\* Example.—Red Pine 16 in. by 12 in., 8 feet long, with 384 cwts. uniformly loaded, (one-eighth the breaking weight) deflects ·066 of an inch; and with 384 cwts. suspended from the middle, (one-fourth the breaking weight) the deflection is ·105 of an inch.



TABLE XVI. *Continued.*

## SCANTLINGS, 16 IN., 17 IN. AND 18 INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	9	10	11	12	13	14	15	16
Depth. Breadth.	WEIGHT IN CWTs.							
16 × 2	56·88	51·20	46·54	42·66	39·38	36·57	34·13	32·00
16 × 2½	71·11	64·00	58·18	53·33	49·23	45·71	42·66	40·00
16 × 3	85·33	76·80	69·81	64·00	59·07	54·85	51·20	48·00
16 × 3½	99·55	89·60	81·45	74·66	68·92	64·00	59·73	56·00
16 × 4	113·77	102·40	93·09	85·33	78·76	73·14	68·26	64·00
16 × 4½	128·00	115·20	104·72	96·00	88·61	82·28	76·80	72·00
16 × 5	142·22	128·00	116·36	106·66	98·46	91·42	85·33	80·00
16 × 5½	156·44	140·80	128·00	117·33	108·30	100·57	93·86	88·00
16 × 6	170·66	153·60	139·63	128·00	118·15	109·71	102·40	96·00
16 × 6½	184·88	166·40	151·27	138·66	128·00	118·85	110·93	104·00
16 × 7	199·11	179·20	162·90	149·33	137·84	128·00	119·46	112·00
16 × 8	227·55	204·80	186·18	170·66	157·53	146·28	136·53	128·00
16 × 9	256·00	230·40	209·45	192·00	177·23	164·57	153·60	144·00
16 × 10	284·44	256·00	232·72	213·33	196·92	182·85	170·66	160·00
16 × 11	312·88	281·60	256·00	234·66	216·61	201·14	187·73	176·00
* 16 × 12	341·33	307·20	279·27	256·00	236·30	219·42	204·80	192·00
16 × 13	369·77	332·80	302·54	277·33	256·00	237·71	221·86	208·00
16 × 14	398·22	358·40	325·81	298·66	275·69	256·00	238·93	224·00
16 × 15	426·66	384·00	349·09	320·00	295·38	274·28	256·00	240·00
16 × 16	455·11	409·60	372·36	341·33	315·07	292·57	273·06	256·00

Deflection in inches of Red Pine 16 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·083	·103	·124	·148	·174	·201	·231	·263
Wt. suspended from the middle.	·133	·164	·199	·237	·278	·322	·370	·421

\* \* \* For Scantlings 17 inches deep, multiply the weights in this table by  $\frac{2 \cdot 89}{2 \cdot 56} = 1 \cdot 1289$ , and the deflections by  $\frac{1 \cdot 6}{1 \cdot 7} = \cdot 941$ .

For Scantlings 18 inches deep, multiply the weights in this table by  $\frac{3 \cdot 1}{2 \cdot 4} = 1 \cdot 2656$ , and the deflections by  $\frac{3}{2} = \cdot 888$ .

\* *Example.*—Red Pine 16 in. by 12 in., 16 feet long, with 192 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·263 of an inch; and with 192 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·421 of an inch.

TABLE XVI. *Continued.*

SCANTLINGS, 16 IN., 17 IN. AND 18 INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.		LENGTH IN FEET, CLEAR BEARING.							
		17	18	19	20	21	22	23	24
Depth.	Breadth.	WEIGHT IN CWTs.							
16 × 2		30·11	28·44	26·94	25·60	24·38	23·27	22·26	21·33
16 × 2½		37·64	35·55	33·68	32·00	30·47	29·09	27·82	26·66
16 × 3		45·17	42·66	40·42	38·40	36·57	34·90	33·39	32·00
16 × 3½		52·70	49·77	47·15	44·80	42·66	40·72	38·95	37·33
16 × 4		60·23	56·88	53·89	51·20	48·76	46·54	44·52	42·66
16 × 4½		67·76	64·00	60·63	57·60	54·85	52·36	50·08	48·00
16 × 5		75·29	71·11	67·36	64·00	60·95	58·18	55·65	53·33
16 × 5½		82·82	78·22	74·10	70·40	67·04	64·00	61·21	58·66
16 × 6		90·35	85·33	80·84	76·80	73·14	69·81	66·78	64·00
16 × 6½		97·88	92·44	87·57	83·20	79·23	75·63	72·34	69·33
16 × 7		105·41	99·55	94·31	89·60	85·33	81·45	77·91	74·66
16 × 8		120·47	113·77	107·78	102·40	97·52	93·09	89·04	85·33
16 × 9		135·52	128·00	121·26	115·20	109·71	104·72	100·17	96·00
16 × 10		150·58	142·22	134·73	128·00	121·90	116·36	111·30	106·66
16 × 11		165·64	156·44	148·21	140·80	134·09	128·00	122·43	117·33
* 16 × 12		180·70	170·66	161·68	153·60	146·28	139·63	133·56	128·00
16 × 13		195·76	184·88	175·15	166·40	158·47	151·27	144·69	138·66
16 × 14		210·82	199·11	188·63	179·20	170·66	162·90	155·82	149·33
16 × 15		225·88	213·33	202·10	192·00	182·85	174·54	166·95	160·00
16 × 16		240·94	227·55	215·57	204·80	195·04	186·18	178·08	170·66

Deflection in inches of Red Pine 16 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	·297	·333	·371	·411	·453	·497	·543	·592
Wt. suspended from the middle.	·475	·532	·593	·657	·725	·795	·869	·947

\* \* For Scantlings 17 inches deep, multiply the weights in this table by  $\frac{2 \cdot 8 \cdot 0}{5 \cdot 6} = 1 \cdot 1289$ , and the deflections by  $\frac{1 \cdot 6}{1 \cdot 7} = \cdot 941$ .

For Scantlings 18 inches deep, multiply the weights in this table by  $\frac{8 \cdot 1}{6 \cdot 4} = 1 \cdot 2656$ , and the deflections by  $\frac{8}{9} = \cdot 888$ .

\* *Example.*—Red Pine 16 in. by 12 in., 24 feet long, with 128 cwt. uniformly loaded, (one-eighth the breaking weight) deflects ·592 of an inch; and with 128 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is ·947 of an inch.

TABLE XVI. *Continued.*

SCANTLINGS, 16 IN., 17 IN. AND 18 INCHES DEEP.

The weights in this table are—

ONE-EIGHTH of the breaking weight of RED PINE, uniformly loaded; or

ONE-FOURTH of the same, when suspended from the middle.

SIZE OF SCANTLINGS, in inches.	LENGTH IN FEET, CLEAR BEARING.							
	25	26	27	28	29	30	31	32
Depth. Breadth.	WEIGHT IN CWTs.							
16 X 2	20.48	19.69	18.96	18.28	17.65	17.06	16.51	16.00
16 X 2½	25.60	24.61	23.70	22.85	22.06	21.33	20.64	20.00
16 X 3	30.72	29.53	28.44	27.42	26.48	25.60	24.77	24.00
16 X 3½	35.84	34.46	33.18	32.00	30.89	29.86	28.90	28.00
16 X 4	40.96	39.38	37.92	36.57	35.31	34.13	33.03	32.00
16 X 4½	46.08	44.30	42.66	41.14	39.72	38.40	37.16	36.00
16 X 5	51.20	49.23	47.40	45.71	44.13	42.66	41.29	40.00
16 X 5½	56.32	54.15	52.14	50.28	48.55	46.93	45.41	44.00
16 X 6	61.44	59.07	56.88	54.85	52.96	51.20	49.54	48.00
16 X 6½	66.56	64.00	61.62	59.42	57.37	55.46	53.67	52.00
16 X 7	71.68	68.92	66.37	64.00	61.79	59.73	57.80	56.00
16 X 8	81.92	78.76	75.85	73.14	70.62	68.26	66.06	64.00
16 X 9	92.16	88.61	85.33	82.28	79.44	76.80	74.32	72.00
16 X 10	102.40	98.46	94.81	91.42	88.27	85.33	82.58	80.00
16 X 11	112.64	108.30	104.29	100.57	97.10	93.86	90.83	88.00
* 16 X 12	122.88	118.15	113.77	109.71	105.93	102.40	99.09	96.00
16 X 13	133.12	128.00	123.25	118.85	114.75	110.93	107.35	104.00
16 X 14	143.36	137.84	132.74	128.00	123.58	119.46	115.61	112.00
16 X 15	153.60	147.69	142.22	137.14	132.41	128.00	123.87	120.00
16 X 16	163.84	157.53	151.70	146.28	141.24	136.53	132.12	128.00

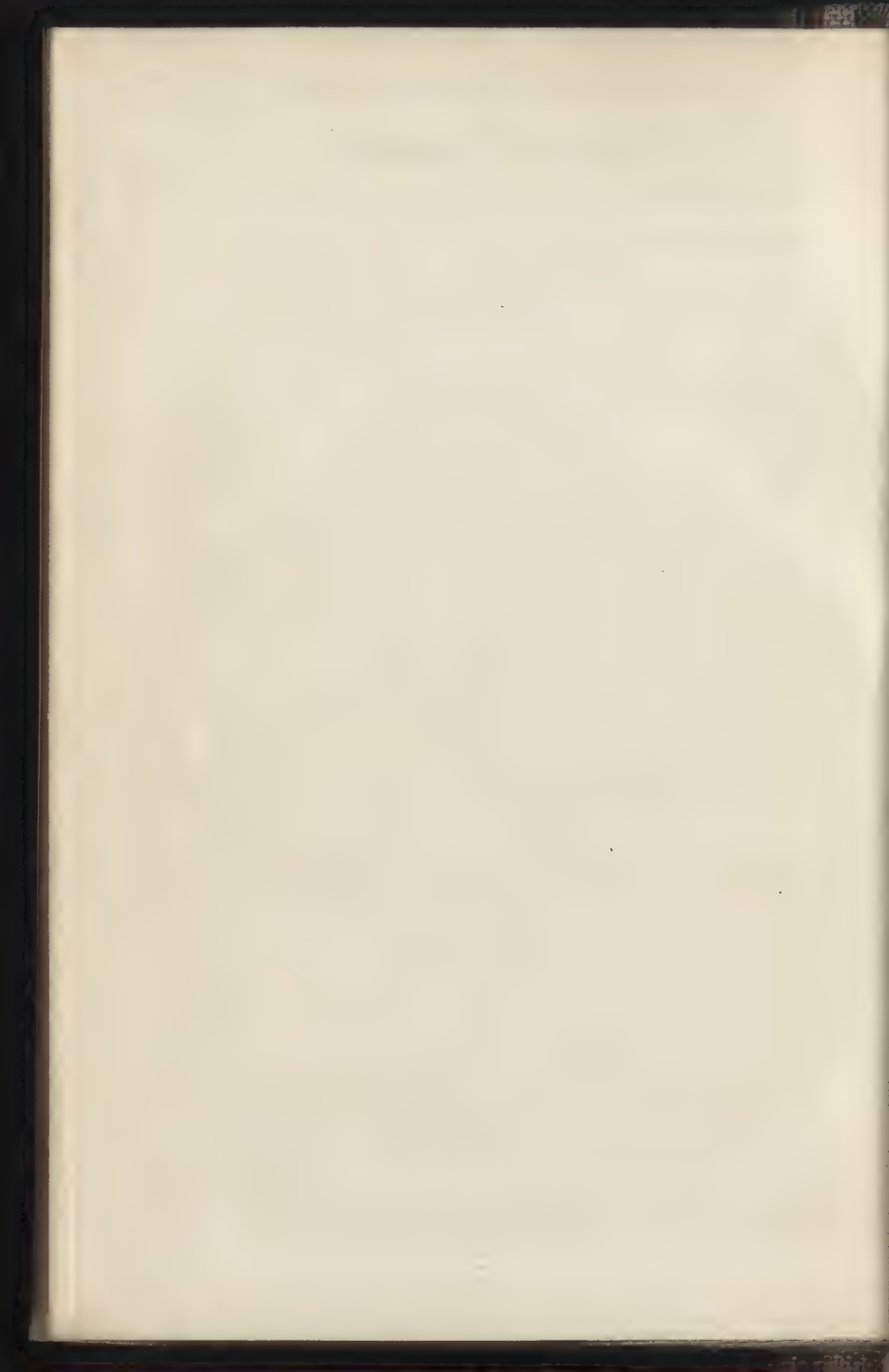
Deflection in inches of Red Pine 16 inches deep, loaded with the weights in this table.

Weight uniformly loaded.	.642	.694	.749	.805	.864	.924	.987	1.052
Wt. suspended from the middle.	1.027	1.111	1.198	1.289	1.382	1.479	1.579	1.683

\* \* For Scantlings 17 inches deep, multiply the weights in this table by  $\frac{2.92}{3.6} = 1.1289$ , and the deflections by  $\frac{1.6}{1.7} = .941$ .

For Scantlings 18 inches deep, multiply the weights in this table by  $\frac{8.1}{6.4} = 1.2656$ , and the deflections by  $\frac{8}{9} = .888$ .

\* Example.—Red Pine 16 in. by 12 in., 28 feet long, with 109.71 cwt. uniformly loaded, (one-eighth the breaking weight) deflects .805 of an inch; and with 109.71 cwt. suspended from the middle, (one-fourth the breaking weight) the deflection is 1.289 inches.





### THIRD SERIES:

BY WHICH MAY BE FOUND THE SCANTLINGS OF ANY DESCRIPTION OF  
TIMBER TO HAVE GIVEN EQUAL DEFLECTIONS, WHEN  
PRESSED BY TWO FORCES;

VIZ.

ONE IN THE DIRECTION OF THE DEPTH; THE OTHER IN THE  
DIRECTION OF THE BREADTH.

## TABLE OF CONSTANTS. No. 3.

By which, and the Third Series of Tables, may be found the Scantlings of the following species of Timber to have the same STRENGTH or DEFLECTION as Red Pine, when acted upon by two forces, viz., one in the direction of the depth, the other in the direction of the breadth.

NAME OF THE WOOD.	Factors to give the depth and breadth, to have the same Strength.	Factors to give the depth and breadth, to have the same Deflection.
	$c = \frac{1}{\sqrt[3]{S}}$	$c = \sqrt[4]{E}$
Standard—Red Pine { Strength, ...1344 Elasticity, 230000 }	1.000	1.000
Acacia.....	.896	1.124
Ash.....	.872	1.028
Beech.....	.952	1.080
Birch, American black.....	.904	1.057
" Common.....	.887	1.028
Bullet tree.....	.797	.915
Cabacally.....	.811	.999
Deal, Christiana.....	.952	1.037
" Memel.....	.919	1.029
Elm.....	1.098	1.279
Fir, Mar Forest.....	1.034	1.216
" New England.....	1.068	1.054
" Riga.....	1.076	1.125
Green-heart.....	.789	.912
Larch.....	1.103	1.191
Locust tree.....	.731	.986
Norway spars.....	.970	1.060
Oak, Adriatic.....	.991	1.173
" African (superior quality).....	.814	.945
" Canadian.....	.913	.987
" Dantzic.....	.971	1.121
" English.....	.980	1.122
Pine, Pitch.....	.937	1.107
" Red, mean strength, 1341.3.....	1.001	1.000
Poon.....	.846	1.022
Teak.....	.817	.934
Tonquin bean.....	.718	.912
	Col. I.	II.

*Note.*—To find the Scantlings of RED PINE BREST-SUMMERS and PURLINS,—see the Diagrams and Examples p. xxiv.—xli.

\* \* \* The Scantlings of other kinds of timber to have the same Strength or Deflection as Red Pine, are found by the Table of Constants, No. 3; as in the following Example.

*Example to the Table of Constants. No. 3.*

By Table IV. page 111, Red Pine 8 feet long 7·18 in.  $\times$  5·08 in., with  $8 \times 500 = 4000$  lbs. pressure in the direction of the depth, and with  $\cdot 50 \times 4000 = 2000$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{8}{30}$  of an inch. Required the Scantlings of Riga Fir to have the same strength, and also the same deflection as Red Pine.

1. To find the Scantling of Riga Fir to have the same Strength as Red Pine.

By Col. I. (p. 96,) for Riga Fir,  $c = 1\cdot076$ ;

$$7\cdot18 \times 1\cdot076 = 7\cdot725; \quad 5\cdot08 \times 1\cdot076 = 5\cdot466. \quad \text{Scantling, } 7\cdot73 \times 5\cdot47.$$

The breaking weight of Riga Fir 8 feet long, 7·73 in.  $\times$  5·47 in., is the same as that of Red Pine 8 feet long, 7·18 in.  $\times$  5·08 in.; viz.,  $8 \times 500 \times 7\cdot325 = 29300$  lbs., in the direction of the depth; or  $8 \times \cdot 5 \times 500 \times 10\cdot36 = 20720$  lbs., in the direction of the breadth; the pressure being uniform in both cases; or one half of those weights if the pressures act in the middle.

2. To find the Scantling of Riga Fir to have the same Deflection as Red Pine.

By Col II. for Riga Fir,  $c = 1\cdot125$ ;

$$7\cdot18 \times 1\cdot125 = 8\cdot077; \quad 5\cdot08 \times 1\cdot125 = 5\cdot715. \quad \text{Scantling } 8\cdot08 \times 5\cdot72.$$

Riga Fir 8 feet long, 8·08 in.  $\times$  5·72 in., with a pressure of 4000 lbs. in the direction of the depth, and 2000 lbs. in the direction of the breadth, deflects each way  $\frac{8}{30}$  of an inch; the pressures being uniform.

TABLE I.

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .16 P$ ;  $P$  = pressure upon each foot in length; } BREADTH = .40  
The deflections each way of the timber are equal..... } DEPTH

Length in feet, clear bearing.	Value of P. 1·0000 lbs.		Value of P. 16·0000 lbs.		Value of P. 39·0625 lbs.		Value of P. 81·0000 lbs.		Value of P. 150·0625 lbs.	
	·0089 cwt.s.		·1428 cwt.s.		·3487 cwt.s.		·7232 cwt.s.		1·3398 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	·35 ×	·14	·70 ×	·28	·87 ×	·35	1·04 ×	·42	1·22 ×	·49
2	·59 ×	·23	1·17 ×	·47	1·46 ×	·59	1·76 ×	·70	2·05 ×	·82
3	·79 ×	·32	1·59 ×	·63	1·98 ×	·79	2·38 ×	·95	2·78 ×	1·11
4	·98 ×	·39	1·97 ×	·79	2·46 ×	·98	2·95 ×	1·18	3·45 ×	1·38
*5	1·16 ×	·47	2·33 ×	·93	2·91 ×	1·16	3·49 ×	1·40	4·07 ×	1·63
6	1·33 ×	·53	2·67 ×	1·07	3·34 ×	1·33	4·00 ×	1·60	4·67 ×	1·87
7	1·50 ×	·60	3·00 ×	1·20	3·74 ×	1·50	4·49 ×	1·80	5·24 ×	2·10
8	1·66 ×	·66	3·31 ×	1·32	4·14 ×	1·66	4·97 ×	1·99	5·79 ×	2·32
9	1·81 ×	·72	3·62 ×	1·45	4·52 ×	1·81	5·43 ×	2·17	6·33 ×	2·53
10	1·96 ×	·78	3·91 ×	1·57	4·89 ×	1·96	5·87 ×	2·35	6·85 ×	2·74
11	2·10 ×	·84	4·20 ×	1·68	5·26 ×	2·10	6·31 ×	2·52	7·36 ×	2·94
12	2·24 ×	·90	4·49 ×	1·80	5·61 ×	2·24	6·73 ×	2·69	7·85 ×	3·14
13	2·38 ×	·95	4·77 ×	1·91	5·96 ×	2·38	7·15 ×	2·86	8·34 ×	3·34
14	2·52 ×	1·01	5·04 ×	2·02	6·30 ×	2·52	7·56 ×	3·02	8·82 ×	3·53
15	2·65 ×	1·06	5·31 ×	2·12	6·63 ×	2·65	7·96 ×	3·18	9·28 ×	3·71
16	2·78 ×	1·11	5·57 ×	2·23	6·96 ×	2·78	8·35 ×	3·34	9·75 ×	3·90
17	2·91 ×	1·17	5·83 ×	2·33	7·28 ×	2·91	8·74 ×	3·50	10·20 ×	4·08
18	3·04 ×	1·22	6·08 ×	2·43	7·60 ×	3·04	9·12 ×	3·65	10·65 ×	4·26
19	3·17 ×	1·27	6·33 ×	2·53	7·92 ×	3·17	9·50 ×	3·80	11·09 ×	4·43
20	3·29 ×	1·32	6·58 ×	2·63	8·23 ×	3·29	9·87 ×	3·95	11·52 ×	4·61

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of P D	40·00 lbs. ·35 cwt.s.	640·00 lbs. 5·71 cwt.s.	1562·50 lbs. 13·94 cwt.s.	3240·00 lbs. 28·92 cwt.s.	6002·50 lbs. 53·59 cwt.s.
Value of P D	25·00 lbs. ·22 cwt.s.	400·00 lbs. 3·57 cwt.s.	976·56 lbs. 8·71 cwt.s.	2025·00 lbs. 18·08 cwt.s.	3751·56 lbs. 33·49 cwt.s.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1·6.	IV. Factor $\frac{4}{3}$ .	V. Factor $\frac{5}{7}$ .†

\* Example.—Red Pine 5 feet long, 1·16 in. by ·47 in., with  $5 \times 1 = 5$  lbs. pressure in the direction of the depth, and with  $1·16 \times 5 = 5·8$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{5}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 5 feet long, 1·16 in. by ·47 in., is  $5 \times 1 \times 5·648 \times 4 = 112·96$  lbs.; and in the direction of the breadth, the breaking weight is  $5 \times 1 \times 1·16 \times 14·122 \times 4 = 45·19$  lbs.; the pressure being uniform in both cases.

† Throughout these tables, in each of the columns VI. to XVIII. (both inclusive) the Factor to give the breaking weight is 1.



TABLE I. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .16 P$ ;  $P$  = pressure upon each foot in length; } BREADTH = .40.  
The deflections each way of the timber are equal..... } DEPTH

Length in feet, clear bearing.	Value of P. 256·0000 lbs.		Value of P. 364·5000 lbs.		Value of P. 500·0000 lbs.		Value of P. 665·5000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	2·2857cwt.		3·2544cwt.		4·4642cwt.		5·9419cwt.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	1·39 ×	·56	1·57 ×	·63	1·74 ×	·70	1·91 ×	·77	3·777	9·444
2	2·34 ×	·94	2·63 ×	1·05	2·93 ×	1·17	3·22 ×	1·29	4·492	11·230
3	3·17 ×	1·27	3·57 ×	1·43	3·97 ×	1·59	4·36 ×	1·75	4·971	12·429
4	3·94 ×	1·58	4·43 ×	1·77	4·92 ×	1·97	5·41 ×	2·17	5·342	13·355
*5	4·66 ×	1·86	5·24 ×	2·09	5·82 ×	2·33	6·40 ×	2·56	5·648	14·122
6	5·34 ×	2·13	6·00 ×	2·40	6·67 ×	2·67	7·34 ×	2·94	5·912	14·780
7	5·99 ×	2·40	6·74 ×	2·70	7·49 ×	3·00	8·24 ×	3·30	6·144	15·361
8	6·62 ×	2·65	7·45 ×	2·98	8·28 ×	3·31	9·11 ×	3·64	6·353	15·882
9	7·23 ×	2·89	8·14 ×	3·26	9·04 ×	3·62	9·95 ×	3·98	6·543	16·357
10	7·83 ×	3·13	8·81 ×	3·52	9·79 ×	3·91	10·76 ×	4·31	6·717	16·794
11	8·41 ×	3·36	9·46 ×	3·78	10·51 ×	4·20	11·56 ×	4·62	6·879	17·199
12	8·98 ×	3·59	10·10 ×	4·04	11·22 ×	4·49	12·34 ×	4·94	7·030	17·577
13	9·53 ×	3·81	10·72 ×	4·29	11·91 ×	4·77	13·11 ×	5·24	7·173	17·932
14	10·08 ×	4·03	11·34 ×	4·53	12·60 ×	5·04	13·85 ×	5·54	7·307	18·267
15	10·61 ×	4·24	11·94 ×	4·78	13·26 ×	5·31	14·59 ×	5·84	7·434	18·585
16	11·14 ×	4·45	12·53 ×	5·01	13·92 ×	5·57	15·31 ×	6·13	7·555	18·888
17	11·66 ×	4·66	13·11 ×	5·25	14·57 ×	5·83	16·03 ×	6·41	7·670	19·176
18	12·17 ×	4·87	13·69 ×	5·47	15·21 ×	6·08	16·73 ×	6·69	7·780	19·452
19	12·67 ×	5·07	14·25 ×	5·70	15·84 ×	6·33	...	...	7·886	19·717
20	13·17 ×	5·27	14·81 ×	5·92	16·46 ×	6·58	...	...	7·988	19·971

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{40}$ of an inch.	$\frac{1}{45}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{55}$ of an inch.	See Examples.
Value of P	10240·00 lbs.	16402·50 lbs.	25000·00 lbs.	36602·50 lbs.	
$\frac{P}{D}$	91·42cwt.	146·45cwt.	223·21cwt.	326·80cwt.	
Value of P	6400·00 lbs.	10251·56 lbs.	15625·00 lbs.	22876·56 lbs.	Pressure in the middle.
$\frac{P}{D}$	57·14cwt.	91·53cwt.	139·50cwt.	204·25cwt.	
VI.		VII.	VIII.	IX.	

\* Example.—Red Pine 5 feet long, 4·66 in. by 1·86 in., with  $5 \times 256 = 1280$  lbs. pressure in the direction of the depth, and with  $.16 \times 1280 = 204·8$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{1}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 5 feet long, 4·66 in. by 1·86 in., is  $5 \times 256 \times 5·648 = 7229·44$  lbs.; and in the direction of the breadth, the breaking weight is  $5 \times 256 \times .16 \times 14·122 = 2892·18$  lbs.; the pressure being uniform in both cases.

\* \* To find the Scantlings of other kinds of timber to have the same deflection or strength as Red Pine, also for the use of the expression  $\frac{P}{D}$ , see Note, page 97.

TABLE I. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .16 P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal..... } DEPTH = .40.

Length in feet, clear bearing.	Value of P. 864·0000 lbs.		Value of P. 1098·5000 lbs.		Value of P. 1372·0000 lbs.		Value of P. 1687·5000 lbs.		Value of P. 2048·0000 lbs.	
	7·7142 cwt.		9·8080 cwt.		12·2500 cwt.		15·0669 cwt.		18·2857 cwt.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	2·09 ×	·84	2·26 ×	·90	2·44 ×	·97	2·61 ×	1·04	2·78 ×	1·11
2	3·51 ×	1·40	3·80 ×	1·52	4·10 ×	1·64	4·39 ×	1·76	4·68 ×	1·87
3	4·76 ×	1·90	5·16 ×	2·06	5·55 ×	2·22	5·95 ×	2·38	6·35 ×	2·54
4	5·91 ×	2·36	6·40 ×	2·56	6·89 ×	2·76	7·38 ×	2·95	7·88 ×	3·15
*5	6·98 ×	2·79	7·56 ×	3·03	8·15 ×	3·26	8·73 ×	3·49	9·31 ×	3·72
6	8·01 ×	3·20	8·67 ×	3·47	9·34 ×	3·74	10·01 ×	4·00	10·67 ×	4·27
7	8·99 ×	3·59	9·74 ×	3·89	10·48 ×	4·19	11·23 ×	4·49	11·98 ×	4·79
8	9·93 ×	3·97	10·76 ×	4·30	11·59 ×	4·64	12·42 ×	4·97	13·24 ×	5·30
9	10·85 ×	4·34	11·76 ×	4·70	12·66 ×	5·06	13·56 ×	5·43	14·47 ×	5·79
10	11·74 ×	4·70	12·72 ×	5·09	13·70 ×	5·48	14·68 ×	5·87	15·66 ×	6·26
11	12·61 ×	5·05	13·66 ×	5·47	14·72 ×	5·89	15·77 ×	6·31	16·82 ×	6·73
12	13·46 ×	5·39	14·59 ×	5·83	15·71 ×	6·28	16·83 ×	6·73	...	...
13	14·30 ×	5·72	15·49 ×	6·20	16·68 ×	6·67	...	...	...	...
14	15·11 ×	6·05	16·37 ×	6·55	...	...	...	...	...	...
15	15·92 ×	6·37	...	...	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of D of P	$\frac{1}{60}$ of an inch.	$\frac{1}{60}$ of an inch.	$\frac{1}{60}$ of an inch.	$\frac{1}{60}$ of an inch.	$\frac{1}{60}$ of an inch.
Value of D of P	51840·00 lbs.	71402·50 lbs.	96040·00 lbs.	126562·50 lbs.	163840·00 lbs.
	462·85 cwt.	637·52 cwt.	857·50 cwt.	1130·02 cwt.	1462·85 cwt.
Value of D of P	32400·00 lbs.	44626·56 lbs.	60025·00 lbs.	79101·56 lbs.	102400·00 lbs.
	289·28 cwt.	398·45 cwt.	535·93 cwt.	706·26 cwt.	914·28 cwt.
	X.	XI.	XII.	XIII.	XIV.

\* *Example 1.*—Red Pine 5 feet long, 6·98 in. by 2·79 in., with  $5 \times 864 = 4320$  lbs. pressure in the direction of the depth, and with  $.16 \times 4320 = 691·2$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{5}{60}$  of an inch; the pressures being uniform throughout the length.

*Example 2.*—Red Pine 5 feet long, 6·98 in. by 2·79 in., with  $\frac{5}{6} \times 4320 = 2700$  lbs. pressure in the direction of the depth, and with  $\frac{5}{6} \times 691·2 = 432$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{5}{60}$  of an inch; the pressures in each case being in the middle.

*Note.*—Uniform pressures, or  $\frac{5}{6}$ ths of the same acting in the middle, the deflections are the same in both cases; as in the above examples.

TABLE I. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = \cdot 16 P$ ;  $P$  = pressure upon each foot in length; } BREADTH = 40.  
The deflections each way of the timber are equal. .... } DEPTH

Length in feet, clear bearing.	Value of P. 2456·5000 lbs 21·9330cwt.		Value of P. 2916·0000 lbs. 26·0357cwt.		Value of P. 3429·5000 lbs. 30·6205cwt.		Value of P. 4000·0000 lbs 35·7142cwt.		Multipliers to give the breaking weight of every Scantling in the table.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	In the direction of the depth.	In the direction of the breadth.
1	2·96 × 1·18	3·13 × 1·25	3·31 × 1·32	3·48 × 1·39	3·777	9·444				
2	4·98 × 1·99	5·27 × 2·11	5·56 × 2·22	5·85 × 2·34	4·492	11·230				
3	6·74 × 2·70	7·14 × 2·86	7·54 × 3·01	7·93 × 3·17	4·971	12·429				
4	8·37 × 3·35	8·86 × 3·54	9·35 × 3·74	9·84 × 3·94	5·342	13·355				
*5	9·89 × 3·96	10·47 × 4·19	11·06 × 4·42	11·64 × 4·66	5·648	14·122				
6	11·34 × 4·54	12·01 × 4·80	12·68 × 5·07	13·34 × 5·34	5·912	14·780				
7	12·73 × 5·09	13·48 × 5·39	14·23 × 5·69	14·98 × 5·99	6·144	15·361				
8	14·07 × 5·63	14·90 × 5·96	15·73 × 6·29	16·56 × 6·62	6·353	15·882				
9	15·37 × 6·15	16·28 × 6·51	...	...	6·543	16·357				
10	16·64 × 6·65	...	...	...	6·717	16·794				
11	...	...	...	...	6·879	17·199				
12	...	...	...	...	7·030	17·577				
13	...	...	...	...	7·173	17·932				
14	...	...	...	...	7·307	18·267				
15	...	...	...	...	7·434	18·585				

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{85}$ of an inch.	$\frac{1}{60}$ of an inch.	$\frac{1}{55}$ of an inch.	$\frac{1}{50}$ of an inch.	See Examples.
Value of $\frac{P}{D}$	208802·50 lbs. 1864·30 cwt.	262440·00 lbs. 2343·21 cwt.	325802·50 lbs. 2908·95 cwt.	400000·00 lbs. 3571·42 cwt.	
Value of $\frac{P}{D}$	130501·56 lbs. 1165·19 cwt.	164025·00 lbs. 1464·50 cwt.	203626·56 lbs. 1818·09 cwt.	250000·00 lbs. 2232·14 cwt.	Pressure in the middle.
	XV.	XVI.	XVII.	XVIII.	

\* *Example.*—Red Pine 5 feet long, 9·89 in. by 3·96 in., with  $5 \times 21·933 = 109·665$  cwt. pressure in the direction of the depth, and with  $\cdot 16 \times 109·665 = 17·5464$  cwt. pressure in the direction of the breadth, deflects each way  $\frac{5}{85}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 5 feet long, 9·89 in. by 3·96 in., is  $5 \times 21·933 \times 5·648 = 619·38$  cwt.; and in the direction of the breadth, the breaking weight is  $5 \times 21·933 \times \cdot 16 \times 14·122 = 247·79$  cwt.; the pressure being uniform in both cases; or one half of those weights, viz., 309·69 cwt. and 123·89 cwt. respectively, the pressures being in the middle.



TABLE II.

SCANTLINGS of RED PINE, when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .25 P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal..... } DEPTH = .50.

Length in feet, clear bearing.	Value of P. 1·0000 lbs.		Value of P. 16·0000 lbs.		Value of P. 39·0625 lbs.		Value of P. 81·0000 lbs.		Value of P. 150·0625 lbs.	
	·0089 cwt.s.		·1428 cwt.s.		·3487 cwt.s.		·7232 cwt.s.		1·3398 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	·33 ×	·16	·66 ×	·33	·82 ×	·41	·99 ×	·49	1·15 ×	·58
2	·55 ×	·28	1·11 ×	·55	1·38 ×	·69	1·66 ×	·83	1·94 ×	·97
3	·75 ×	·38	1·50 ×	·75	1·88 ×	·94	2·25 ×	1·13	2·63 ×	1·31
4	·93 ×	·47	1·86 ×	·93	2·33 ×	1·16	2·79 ×	1·40	3·26 ×	1·63
5	1·10 ×	·55	2·20 ×	1·10	2·75 ×	1·38	3·30 ×	1·65	3·85 ×	1·93
*6	1·26 ×	·63	2·52 ×	1·26	3·15 ×	1·58	3·79 ×	1·89	4·42 ×	2·21
7	1·42 ×	·71	2·83 ×	1·42	3·54 ×	1·77	4·25 ×	2·12	4·96 ×	2·48
8	1·57 ×	·78	3·13 ×	1·57	3·91 ×	1·96	4·70 ×	2·35	5·48 ×	2·74
9	1·71 ×	·86	3·42 ×	1·71	4·28 ×	2·14	5·13 ×	2·57	5·99 ×	2·99
10	1·85 ×	·93	3·70 ×	1·85	4·63 ×	2·31	5·55 ×	2·78	6·48 ×	3·24
11	1·99 ×	·99	3·98 ×	1·99	4·97 ×	2·49	5·96 ×	2·98	6·96 ×	3·48
12	2·12 ×	1·06	4·24 ×	2·12	5·31 ×	2·65	6·37 ×	3·18	7·43 ×	3·71
13	2·25 ×	1·13	4·51 ×	2·25	5·63 ×	2·82	6·76 ×	3·38	7·89 ×	3·94
14	2·38 ×	1·19	4·76 ×	2·38	5·96 ×	2·98	7·15 ×	3·57	8·34 ×	4·17
15	2·51 ×	1·25	5·02 ×	2·51	6·27 ×	3·14	7·53 ×	3·76	8·78 ×	4·39
16	2·63 ×	1·32	5·27 ×	2·63	6·58 ×	3·29	7·90 ×	3·95	9·22 ×	4·61
17	2·76 ×	1·38	5·51 ×	2·76	6·89 ×	3·44	8·27 ×	4·13	9·65 ×	4·82
18	2·88 ×	1·44	5·75 ×	2·88	7·20 ×	3·60	8·63 ×	4·31	10·07 ×	5·03
19	3·00 ×	1·50	5·99 ×	3·00	7·49 ×	3·74	8·99 ×	4·49	10·48 ×	5·24
20	3·11 ×	1·56	6·23 ×	3·11	7·78 ×	3·89	9·34 ×	4·67	10·90 ×	5·45

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of P	40·00 lbs.	640·00 lbs.	1562·50 lbs.	3240·00 lbs.	6002·50 lbs.
D	·35 cwt.s.	5·71 cwt.s.	13·94 cwt.s.	28·92 cwt.s.	53·59 cwt.s.
Value of P	25·00 lbs.	400·00 lbs.	976·56 lbs.	2025·00 lbs.	3751·56 lbs.
D	·22 cwt.s.	3·57 cwt.s.	8·71 cwt.s.	18·08 cwt.s.	33·49 cwt.s.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1·6.	IV. Factor $\frac{4}{3}$ .	V. Factor $\frac{8}{7}$ .

\* Example.—Red Pine 6 feet long, 2·52 in. by 1·26 in., with  $6 \times 16 = 96$  lbs. pressure in the direction of the depth, and with  $.25 \times 96 = 24$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{6}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 6 feet long, 2·52 in. by 1·26 in., is  $6 \times 16 \times 6 \cdot 251 \times 2 = 1200$  lbs.; and in the direction of the breadth, the breaking weight is  $6 \times 16 \times .25 \times 12 \cdot 503 \times 2 = 600$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE II. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .25 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .50$ .  
The deflections each way of the timber are equal.... }

Length in feet, clear bearing.	Value of P. 256·0000 lbs.		Value of P. 364·5000 lbs.		Value of P. 500·0000 lbs.		Value of P. 665·5000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	2·2857cwts.		3·2544cwts.		4·4642cwts.		5·9419cwts.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	1·32	× ·66	1·48	× ·74	1·65	× ·82	1·81	× ·91	3·994	7·988
2	2·21	× 1·11	2·49	× 1·25	2·77	× 1·38	3·04	× 1·52	4·750	9·500
3	3·00	× 1·50	3·38	× 1·69	3·75	× 1·88	4·13	× 2·06	5·256	10·513
4	3·72	× 1·86	4·19	× 2·09	4·66	× 2·33	5·12	× 2·56	5·648	11·297
5	4·40	× 2·20	4·95	× 2·48	5·50	× 2·75	6·05	× 3·03	5·972	11·945
*6	5·05	× 2·52	5·68	× 2·84	6·31	× 3·15	6·94	× 3·47	6·251	12·503
7	5·67	× 2·83	6·37	× 3·19	7·08	× 3·54	7·79	× 3·90	6·497	12·994
8	6·26	× 3·13	7·05	× 3·52	7·83	× 3·91	8·61	× 4·31	6·717	13·435
9	6·84	× 3·42	7·70	× 3·85	8·55	× 4·28	9·41	× 4·70	6·918	13·836
10	7·40	× 3·70	8·33	× 4·16	9·26	× 4·63	10·18	× 5·09	7·103	14·206
11	7·95	× 3·98	8·95	× 4·47	9·94	× 4·97	10·93	× 5·47	7·274	14·548
12	8·49	× 4·24	9·55	× 4·77	10·61	× 5·31	11·67	× 5·84	7·434	14·868
13	9·01	× 4·51	10·14	× 5·07	11·27	× 5·63	12·39	× 6·20	7·584	15·169
14	9·53	× 4·76	10·72	× 5·36	11·91	× 5·96	13·10	× 6·55	7·726	15·452
15	10·04	× 5·02	11·29	× 5·64	12·54	× 6·27	13·80	× 6·90	7·860	15·721
16	10·53	× 5·27	11·85	× 5·92	13·17	× 6·58	14·48	× 7·24	7·988	15·977
17	11·02	× 5·51	12·40	× 6·20	13·78	× 6·89	15·16	× 7·58	8·110	16·221
18	11·51	× 5·75	12·94	× 6·47	14·38	× 7·19	15·82	× 7·91	8·227	16·454
19	11·98	× 5·99	13·48	× 6·74	14·98	× 7·49	...	...	8·339	16·678
20	12·45	× 6·23	14·01	× 7·00	15·57	× 7·78	...	...	8·447	16·894

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{45}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{55}$ of an inch.	See Examples.
Value of P D	10240·00 lbs. 91·42cwts.	16402·50 lbs. 146·45cwts.	25000·00 lbs. 223·21cwts.	36602·50 lbs. 326·80cwts.	
Value of P D	6400·00 lbs. 57·14cwts.	10251·56 lbs. 91·53cwts.	15625·00 lbs. 139·50cwts.	22876·56 lbs. 204·25cwts.	Pressure in the middle.
	VI.	VII.	VIII.	IX.	

\* *Example.*—Red Pine 6 feet long, 5·68 in. by 2·84 in., with  $6 \times 364·5 = 2187$  lbs. pressure in the direction of the depth, and with  $.25 \times 2187 = 546·75$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{6}{45}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 6 feet long, 5·68 in. by 2·84 in., is  $6 \times 364·5 \times 6·251 = 13670$  lbs.; and in the direction of the breadth, the breaking weight is  $6 \times 364·5 \times .25 \times 12·503 = 7305$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE II. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .25 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .50$ .  
The deflections each way of the timber are equal..... }

Length in feet, clear bearing.	Value of P. 864·0000 lbs.		Value of P. 1098·5000 lbs.		Value of P. 1372·0000 lbs.		Value of P. 1687·5000 lbs.		Value of P. 2048·0000 lbs.	
	7·7142 cwts.		9·8080 cwts.		12·2500 cwts.		15·0669 cwts.		18·2857 cwts.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	1·97	× .99	2·14	× 1·07	2·30	× 1·15	2·47	× 1·23	2·63	× 1·32
2	3·32	× 1·66	3·60	× 1·80	3·87	× 1·94	4·15	× 2·08	4·43	× 2·21
3	4·50	× 2·25	4·88	× 2·44	5·25	× 2·63	5·63	× 2·81	6·00	× 3·00
4	5·59	× 2·79	6·05	× 3·03	6·52	× 3·26	6·98	× 3·49	7·45	× 3·72
5	6·60	× 3·30	7·15	× 3·58	7·70	× 3·85	8·25	× 4·13	8·80	× 4·40
*6	7·57	× 3·79	8·20	× 4·10	8·83	× 4·42	9·46	× 4·73	10·10	× 5·05
7	8·50	× 4·25	9·21	× 4·60	9·92	× 4·96	10·62	× 5·31	11·33	× 5·67
8	9·39	× 4·70	10·18	× 5·09	10·96	× 5·48	11·74	× 5·87	12·53	× 6·26
9	10·26	× 5·13	11·12	× 5·56	11·97	× 5·99	12·83	× 6·41	13·68	× 6·84
10	11·11	× 5·55	12·03	× 6·02	12·96	× 6·48	13·88	× 6·94	14·81	× 7·40
11	11·93	× 5·96	12·92	× 6·46	13·92	× 6·96	14·91	× 7·46	15·91	× 7·95
12	12·73	× 6·37	13·79	× 6·90	14·86	× 7·43	15·92	× 7·96	...	...
13	13·52	× 6·76	14·65	× 7·32	15·78	× 7·89	...	...	...	...
14	14·29	× 7·15	15·49	× 7·74	...	...	...	...	...	...
15	15·05	× 7·53	16·31	× 8·15	...	...	...	...	...	...
16	15·80	× 7·90	...	...	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of $\frac{D}{P}$	$\frac{1}{60}$ of an inch.	$\frac{1}{65}$ of an inch.	$\frac{1}{70}$ of an inch.	$\frac{1}{75}$ of an inch.	$\frac{1}{80}$ of an inch.
Value of $\frac{P}{D}$	51840·00 lbs.	71402·50 lbs.	96040·00 lbs.	126562·50 lbs.	163840·00 lbs.
	462·85 cwts.	637·52 cwts.	857·50 cwts.	1130·02 cwts.	1462·85 cwts.
Value of $\frac{P}{D}$	32400·00 lbs.	44626·56 lbs.	60025·00 lbs.	79101·56 lbs.	102400·00 lbs.
	289·28 cwts.	398·45 cwts.	535·93 cwts.	706·26 cwts.	914·28 cwts.
	X.	XI.	XII.	XIII.	XIV.

\* *Example.*—Red Pine 6 feet long, 8·20 in. by 4·10 in., with  $6 \times 9·808 = 58·848$  cwts. pressure in the direction of the depth, and with  $.25 \times 58·848 = 14·712$  cwts. pressure in the direction of the breadth, deflects each way  $\frac{6}{65}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 6 feet long, 8·20 in. by 4·10 in., is  $6 \times 9·808 \times 6·251 = 367·85$  cwts.; and in the direction of the breadth, the breaking weight is  $6 \times 9·808 \times .25 \times 12·503 = 122·62$  cwts.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE II. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .25 P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal..... } DEPTH = .50.

Length in feet, clear bearing.	Value of P. 2456·5000 lbs		Value of P. 2916·0000 lbs.		Value of P. 3429·5000 lbs.		Value of P. 4000·0000 lbs		Multipliers to give the breaking weight of every Scantling in the table.	
	21·9330 cwt.		26·0357 cwt.		30·6205 cwt.		35·7142 cwt.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	2·80	1·40	2·96	1·48	3·13	1·56	3·29	1·65	3·994	7·988
2	4·71	2·35	4·98	2·49	5·26	2·63	5·54	2·77	4·750	9·500
3	6·38	3·19	6·75	3·38	7·13	3·56	7·50	3·75	5·256	10·513
4	7·91	3·96	8·38	4·19	8·84	4·42	9·31	4·66	5·648	11·297
5	9·35	4·68	9·91	4·95	10·46	5·23	11·01	5·50	5·972	11·945
*6	10·73	5·36	11·36	5·68	11·99	5·99	12·62	6·31	6·251	12·503
7	12·04	6·02	12·75	6·37	13·46	6·73	14·17	7·08	6·497	12·994
8	13·31	6·65	14·09	7·05	14·88	7·44	15·66	7·83	6·717	13·435
9	14·54	7·27	15·39	7·70	16·25	8·12	...	...	6·918	13·836
10	15·73	7·87	...	...	...	...	...	...	7·103	14·206
11	...	...	...	...	...	...	...	...	7·274	14·548
12	...	...	...	...	...	...	...	...	7·434	14·868
13	...	...	...	...	...	...	...	...	7·584	15·169
14	...	...	...	...	...	...	...	...	7·726	15·452
15	...	...	...	...	...	...	...	...	7·860	15·721
16	...	...	...	...	...	...	...	...	7·988	15·977

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{85}$ of an inch.	$\frac{1}{80}$ of an inch.	$\frac{1}{75}$ of an inch.	$\frac{1}{70}$ of an inch.	See Examples.
Value of P D	208802·50 lbs.	262440·00 lbs.	325802·50 lbs.	400000·00 lbs.	
	1864·30 cwt.	2343·21 cwt.	2908·95 cwt.	3571·42 cwt.	} Pressure uniform.
Value of P D	130501·56 lbs.	164025·00 lbs.	203626·56 lbs.	250000·00 lbs.	
	1165·19 cwt.	1464·50 cwt.	1818·09 cwt.	2232·14 cwt.	} Pressure in the middle.
	XV.	XVI.	XVII.	XVIII.	

\* *Example.*—Red Pine 6 feet long, 11·36 in. by 5·68 in., with  $6 \times 26·0357 = 156·214$  cwt. pressure in the direction of the depth, and with  $.25 \times 156·214 = 39·053$  cwt. pressure in the direction of the breadth, deflects each way  $\frac{6}{90}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 6 feet long, 11·36 in. by 5·68 in., is  $6 \times 26·0357 \times 6·251 = 976·49$  cwt.; and in the direction of the breadth, the breaking weight is  $6 \times 26·0357 \times .25 \times 12·503 = 488·25$  cwt.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE III.

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .36 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .60$ .  
The deflections each way of the timber are equal..... }

Length in feet, clear bearing.	Value of P. 1'0000 lbs. .0089 cwt.s.		Value of P. 16'0000 lbs. .1428 cwt.s.		Value of P. 39'0625 lbs. .3487 cwt.s.		Value of P. 81'0000 lbs. .7232 cwt.s.		Value of P. 150'0625 lbs. 1'3398 cwt.s.	
	Depth. Breadth.		Depth. Breadth.		Depth. Breadth.		Depth. Breadth.		Depth. Breadth.	
	1	2	3	4	5	6	7	8	9	10
1	.31 × .19	.63 × .38	.79 × .47	.94 × .57	1.10 × .66	1.21 × .72	1.35 × .81	1.50 × .90	1.63 × .98	1.77 × 1.06
2	.53 × .32	1.06 × .63	1.32 × .79	1.59 × .95	1.85 × 1.11	2.12 × .81	2.41 × 1.62	2.69 × 1.80	2.97 × 1.96	3.25 × 2.12
3	.72 × .43	1.43 × .86	1.79 × 1.08	2.15 × 1.29	2.51 × 1.51	2.78 × .53	3.17 × 1.07	3.56 × 1.58	3.95 × 2.26	4.34 × 2.53
4	.89 × .53	1.78 × 1.07	2.22 × 1.33	2.67 × 1.60	3.11 × 1.87	2.10 × 1.26	2.41 × 1.45	2.71 × 1.62	3.01 × 1.81	3.31 × 2.03
5	1.05 × .63	2.10 × 1.26	2.63 × 1.58	3.15 × 1.89	3.68 × 2.21	3.01 × 1.81	3.38 × 2.03	3.74 × 2.24	4.09 × 2.45	4.42 × 2.65
6	1.21 × .72	2.41 × 1.45	3.01 × 1.81	3.62 × 2.17	4.22 × 2.53	3.38 × 2.03	3.80 × 2.80	4.19 × 2.58	4.58 × 2.73	4.97 × 3.00
*7	1.35 × .81	2.71 × 1.62	3.38 × 2.03	4.06 × 2.44	4.74 × 2.84	3.74 × 2.24	4.06 × 2.43	4.38 × 2.65	4.70 × 2.87	5.02 × 3.09
8	1.50 × .90	2.99 × 1.80	3.74 × 2.24	4.49 × 2.69	5.24 × 3.14	4.49 × 2.69	4.81 × 2.91	5.13 × 3.13	5.45 × 3.35	5.77 × 3.57
9	1.63 × .98	3.27 × 1.96	4.09 × 2.45	4.90 × 2.94	5.72 × 3.43	4.90 × 2.94	5.22 × 3.16	5.54 × 3.38	5.86 × 3.60	6.18 × 3.82
10	1.77 × 1.06	3.54 × 2.12	4.42 × 2.65	5.31 × 3.18	6.19 × 3.71	5.31 × 3.18	5.63 × 3.40	5.95 × 3.62	6.27 × 3.84	6.59 × 4.06
11	1.90 × 1.14	3.80 × 2.80	4.75 × 2.85	5.70 × 3.42	6.65 × 3.99	5.70 × 3.42	6.02 × 3.64	6.34 × 3.86	6.66 × 4.08	6.98 × 4.30
12	2.03 × 1.22	4.06 × 2.43	5.07 × 3.04	6.08 × 3.65	7.10 × 4.26	6.08 × 3.65	6.40 × 3.87	6.72 × 4.09	7.04 × 4.31	7.36 × 4.53
13	2.15 × 1.29	4.31 × 2.58	5.38 × 3.23	6.46 × 3.88	7.54 × 4.52	6.46 × 3.88	6.78 × 4.10	7.10 × 4.32	7.42 × 4.54	7.74 × 4.76
14	2.28 × 1.37	4.55 × 2.73	5.69 × 3.41	6.83 × 4.10	7.97 × 4.78	6.83 × 4.10	7.15 × 4.32	7.47 × 4.54	7.79 × 4.76	8.11 × 4.98
15	2.40 × 1.44	4.79 × 2.88	5.99 × 3.60	7.19 × 4.31	8.39 × 5.03	7.19 × 4.31	7.51 × 4.53	7.83 × 4.75	8.15 × 4.97	8.47 × 5.19
16	2.52 × 1.51	5.03 × 3.02	6.29 × 3.77	7.55 × 4.53	8.81 × 5.28	7.55 × 4.53	7.87 × 4.75	8.19 × 4.97	8.51 × 5.19	8.83 × 5.41
17	2.63 × 1.58	5.27 × 3.16	6.58 × 3.95	7.90 × 4.74	9.22 × 5.53	7.90 × 4.74	8.22 × 4.96	8.54 × 5.18	8.86 × 5.40	9.18 × 5.62
18	2.75 × 1.65	5.50 × 3.30	6.87 × 4.12	8.24 × 4.95	9.62 × 5.77	8.24 × 4.95	8.56 × 5.17	8.88 × 5.39	9.20 × 5.61	9.52 × 5.83
19	2.86 × 1.72	5.72 × 3.43	7.16 × 4.29	8.59 × 5.15	10.02 × 6.01	8.59 × 5.15	8.91 × 5.37	9.23 × 5.59	9.55 × 5.81	9.87 × 6.03
20	2.97 × 1.78	5.95 × 3.57	7.44 × 4.46	8.92 × 5.35	10.41 × 6.25	8.92 × 5.35	9.24 × 5.57	9.56 × 5.79	9.88 × 6.01	10.20 × 6.23

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of $\frac{P}{D}$	40.00 lbs. .35 cwt.s.	640.00 lbs. 5.71 cwt.s.	1562.50 lbs. 13.94 cwt.s.	3240.00 lbs. 28.92 cwt.s.	6002.50 lbs. 53.59 cwt.s.
Value of $\frac{P}{D}$	25.00 lbs. .22 cwt.s.	400.00 lbs. 3.57 cwt.s.	976.56 lbs. 8.71 cwt.s.	2025.00 lbs. 18.08 cwt.s.	3751.56 lbs. 33.49 cwt.s.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1.6.	IV. Factor $\frac{4}{3}$ .	V. Factor $\frac{3}{2}$ .

\* Example.—Red Pine 7 feet long, 3.38 in. by 2.03 in., with  $7 \times 39.0625 = 273.4$  lbs. pressure in the direction of the depth, and with  $.36 \times 273.4 = 98.4$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{7}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 7 feet long, 3.38 in. by 2.03 in., is  $7 \times 39.0625 \times 6.8 \times 1.6 = 2975$  lbs.; and in the direction of the breadth, the breaking weight is  $7 \times 39.0625 \times .36 \times 11.333 \times 1.6 = 1785$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE III. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .36 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .60$ .  
The deflections each way of the timber are equal..... }

Length in feet, clear bearing.	Value of P. 256·0000 lbs.		Value of P. 364·5000 lbs.		Value of P. 500·0000 lbs.		Value of P. 665·5000 lbs.		Multipliers to give the <i>breaking weight</i> of every Scantling in the table.	
	2·2857 cwt.		3·2544 cwt.		4·4642 cwt.		5·9419 cwt.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	1·26 ×	·75	1·42 ×	·85	1·57 ×	·94	1·73 ×	1·04	4·180	6·967
2	2·12 ×	1·27	2·38 ×	1·43	2·64 ×	1·59	2·91 ×	1·75	4·971	8·286
3	2·87 ×	1·72	3·23 ×	1·94	3·58 ×	2·15	3·94 ×	2·37	5·502	9·170
4	3·56 ×	2·13	4·00 ×	2·40	4·45 ×	2·67	4·89 ×	2·94	5·912	9·853
5	4·21 ×	2·52	4·73 ×	2·84	5·26 ×	3·15	5·78 ×	3·47	6·251	10·419
6	4·82 ×	2·89	5·43 ×	3·26	6·03 ×	3·62	6·63 ×	3·98	6·543	10·905
*7	5·41 ×	3·25	6·09 ×	3·65	6·77 ×	4·06	7·44 ×	4·47	6·800	11·333
8	5·98 ×	3·59	6·73 ×	4·04	7·48 ×	4·49	8·23 ×	4·94	7·030	11·718
9	6·54 ×	3·92	7·35 ×	4·41	8·17 ×	4·90	8·99 ×	5·39	7·241	12·068
10	7·07 ×	4·24	7·96 ×	4·78	8·84 ×	5·31	9·73 ×	5·84	7·434	12·390
11	7·60 ×	4·56	8·55 ×	5·13	9·50 ×	5·70	10·45 ×	6·27	7·613	12·689
12	8·11 ×	4·87	9·12 ×	5·47	10·14 ×	6·08	11·15 ×	6·69	7·781	12·968
13	8·61 ×	5·17	9·69 ×	5·81	10·77 ×	6·46	11·84 ×	7·11	7·938	13·230
14	9·10 ×	5·46	10·24 ×	6·15	11·38 ×	6·83	12·52 ×	7·51	8·086	13·477
15	9·59 ×	5·75	10·79 ×	6·47	11·99 ×	7·19	13·18 ×	7·91	8·227	13·712
16	10·06 ×	6·04	11·32 ×	6·79	12·58 ×	7·55	13·84 ×	8·30	8·361	13·935
17	10·53 ×	6·32	11·85 ×	7·11	13·16 ×	7·90	14·48 ×	8·69	8·488	14·148
18	10·99 ×	6·60	12·37 ×	7·42	13·74 ×	8·24	15·12 ×	9·07	8·611	14·351
19	11·45 ×	6·87	12·88 ×	7·73	14·31 ×	8·59	15·74 ×	9·44	8·728	14·547
20	11·90 ×	7·14	13·38 ×	8·03	14·87 ×	8·92	16·36 ×	9·82	8·840	14·734

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{35}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{25}$ of an inch.	See Examples.
Value of P D	10240·00 lbs. 91·42 cwt.	16402·50 lbs. 146·45 cwt.	25000·00 lbs. 223·21 cwt.	36602·50 lbs. 326·80 cwt.	
Value of P D	6400·00 lbs. 57·14 cwt.	10251·56 lbs. 91·53 cwt.	15625·00 lbs. 139·50 cwt.	22876·56 lbs. 204·25 cwt.	Pressure in the middle.

VI.

VII.

VIII.

IX.

\* *Example.*—Red Rine 7 feet long, 6·77 in. by 4·06 in., with  $7 \times 500 = 3500$  lbs. pressure in the direction of the depth, and with  $.36 \times 3500 = 1260$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{7}{30}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 7 feet long, 6·77 in. by 4·06 in., is  $7 \times 500 \times 6·8 = 23800$  lbs.; and in the direction of the breadth, the breaking weight is  $7 \times 500 \times .36 \times 11·333 = 14280$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE III. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = \cdot 36 P$ ;  $P$  = pressure upon each foot in length;  $\left( \frac{\text{BREADTH}}{\text{DEPTH}} = \cdot 60 \right.$   
The deflections each way of the timber are equal.....

Length in feet, clear bearing.	Value of P. 864·0000 lbs.		Value of P. 1098·5000 lbs.		Value of P. 1372·0000 lbs.		Value of P. 1687·5000 lbs.		Value of P. 2048·0000 lbs.	
	7·7142 cwt.s.		9·8080 cwt.s.		12·2500 cwt.s.		15·0669 cwt.s.		18·2857 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	1·89	× 1·13	2·04	× 1·23	2·20	× 1·32	2·36	× 1·42	2·52	× 1·51
2	3·17	× 1·90	3·44	× 2·06	3·70	× 2·22	3·97	× 2·38	4·23	× 2·54
3	4·30	× 2·58	4·66	× 2·80	5·02	× 3·01	5·38	× 3·23	5·74	× 3·44
4	5·34	× 3·20	5·78	× 3·47	6·23	× 3·74	6·67	× 4·00	7·12	× 4·27
5	6·31	× 3·79	6·84	× 4·10	7·36	× 4·42	7·89	× 4·73	8·41	× 5·05
6	7·23	× 4·34	7·84	× 4·70	8·44	× 5·06	9·04	× 5·43	9·65	× 5·79
*7	8·12	× 4·87	8·80	× 5·28	9·47	× 5·68	10·15	× 6·09	10·83	× 6·50
8	8·98	× 5·39	9·72	× 5·83	10·47	× 6·28	11·22	× 6·73	11·97	× 7·18
9	9·80	× 5·88	10·62	× 6·37	11·44	× 6·86	12·26	× 7·35	13·07	× 7·84
10	10·61	× 6·37	11·50	× 6·90	12·38	× 7·43	13·26	× 7·96	14·15	× 8·49
11	11·40	× 6·84	12·35	× 7·41	13·30	× 7·98	14·25	× 8·55	15·20	× 9·12
12	12·17	× 7·30	13·18	× 7·91	14·19	× 8·52	15·21	× 9·12	16·22	× 9·73
13	12·92	× 7·75	14·00	× 8·40	15·07	× 9·04	16·15	× 9·69	...	...
14	13·66	× 8·19	14·80	× 8·88	15·93	× 9·56	...	...	...	...
15	14·38	× 8·63	15·58	× 9·35	16·78	× 10·07	...	...	...	...
16	15·10	× 9·06	16·35	× 9·81	...	...	...	...	...	...
17	15·80	× 9·48	...	...	...	...	...	...	...	...
18	16·49	× 9·89	...	...	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{60}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{20}$ of an inch.
Value of P	51840·00 lbs.	71402·50 lbs.	96040·00 lbs.	126562·50 lbs.	163840·00 lbs.
$\frac{P}{D}$	462·85 cwt.s.	637·52 cwt.s.	857·50 cwt.s.	1130·02 cwt.s.	1462·85 cwt.s.
Value of P	32400·00 lbs.	44626·56 lbs.	60025·00 lbs.	79101·56 lbs.	102400·00 lbs.
$\frac{P}{D}$	289·28 cwt.s.	398·45 cwt.s.	535·93 cwt.s.	706·26 cwt.s.	914·28 cwt.s.
	X.	XI.	XII.	XIII.	XIV.

\* *Example.*—Red Pine 7 feet long, 9·47 in. by 5·68 in., with  $7 \times 12 \cdot 25 = 85 \cdot 75$  cwt.s. pressure in the direction of the depth, and with  $\cdot 36 \times 85 \cdot 75 = 30 \cdot 87$  cwt.s. pressure in the direction of the breadth, deflects each way  $\frac{7}{60}$  or  $\frac{1}{10}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine, 7 feet long, 9·47 in. by 5·68 in. is  $7 \times 12 \cdot 25 \times 6 \cdot 8 = 583 \cdot 1$  cwt.s.; and in the direction of the breadth, the breaking weight is  $7 \times 12 \cdot 25 \times \cdot 36 \times 11 \cdot 333 = 349 \cdot 8$  cwt.s.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE III. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .36 P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal..... } DEPTH = .60.

Length in feet, clear bearing.	Value of P. 2456·5000lbs.		Value of P. 2916·0000lbs.		Value of P. 3429·5000 lbs.		Value of P. 4000·0000lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	21·9330cwt.		26·0357cwt.		30·6205 cwt.		35·7142cwt.		In the direction of the depth.	In the direction of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	2·67	× 1·60	2·83	× 1·70	2·99	× 1·79	3·14	× 1·89	4·180	6·967
2	4·50	× 2·70	4·76	× 2·86	5·02	× 3·01	5·29	× 3·17	4·971	8·286
3	6·09	× 3·66	6·45	× 3·87	6·81	× 4·09	7·17	× 4·30	5·502	9·170
4	7·56	× 4·54	8·01	× 4·80	8·45	× 5·07	8·90	× 5·34	5·912	9·853
5	8·94	× 5·36	9·46	× 5·68	9·99	× 5·99	10·52	× 6·31	6·251	10·419
6	10·25	× 6·15	10·85	× 6·51	11·45	× 6·87	12·06	× 7·23	6·543	10·905
*7	11·50	× 6·90	12·18	× 7·31	12·86	× 7·71	13·53	× 8·12	6·800	11·333
8	12·72	× 7·63	13·46	× 8·08	14·21	× 8·53	14·96	× 8·98	7·030	11·718
9	13·89	× 8·33	14·71	× 8·82	15·52	× 9·31	16·34	× 9·80	7·241	12·068
10	15·03	× 9·02	15·92	× 9·55	16·80	× 10·08	...	...	7·434	12·390
11	16·15	× 9·69	...	...	...	...	...	...	7·613	12·689
12	...	...	...	...	...	...	...	...	7·781	12·968
13	...	...	...	...	...	...	...	...	7·938	13·230
14	...	...	...	...	...	...	...	...	8·086	13·477
15	...	...	...	...	...	...	...	...	8·227	13·712
16	...	...	...	...	...	...	...	...	8·361	13·935
17	...	...	...	...	...	...	...	...	8·488	14·148
18	...	...	...	...	...	...	...	...	8·611	14·351

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{85}$ of an inch.	$\frac{1}{90}$ of an inch.	$\frac{1}{95}$ of an inch.	$\frac{1}{100}$ of an inch.	See Examples.
Value of P D	208802·50 lbs. 1864·30cwt.	262440·00 lbs. 2343·21cwt.	325802·50 lbs. 2908·95cwt.	400000·00 lbs. 3571·42cwt.	
Value of P D	130501·56 lbs. 1165·19cwt.	164025·00 lbs. 1464·50cwt.	203626·56 lbs. 1818·09cwt.	250000·00 lbs. 2232·14cwt.	Pressure uniform. Pressure in the middle.
XV.		XVI.		XVII.	
				XVIII.	

\* Example—Red Pine, 7 feet long, 12·86 in. by 7·71 in., with  $7 \times 30·6205 = 214·34$  cwt. pressure in the direction of the depth, and with  $.36 \times 214·34 = 77·16$  cwt. pressure in the direction of the breadth, deflects each way  $\frac{7}{95}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 7 feet long, 12·86 in. by 7·71 in., is  $7 \times 30·6205 \times 6·8 = 1457·5$  cwt.; and in the direction of the breadth, the breaking weight is  $7 \times 30·6205 \times .36 \times 11·333 = 874·52$  cwt.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE IV.

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .50 P$ ;  $P =$  pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .707$ .  
The deflections each way of the timber are equal. .... }

Length in feet, clear bearing.	Value of P.		Value of P.		Value of P.		Value of P.		Value of P.	
	1·0000 lbs.		16·0000 lbs.		39·0625 lbs.		81·0000 lbs.		150·0625 lbs.	
	·0089 cwt.s.		·1428 cwt.s.		·3487 cwt.s.		·7232 cwt.s.		1·3398 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	·30 ×	·21	·60 ×	·43	·75 ×	·53	·91 ×	·64	1·06 ×	·75
2	·51 ×	·36	1·02 ×	·72	1·27 ×	·90	1·52 ×	1·08	1·78 ×	1·26
3	·69 ×	·49	1·38 ×	·97	1·72 ×	1·22	2·06 ×	1·46	2·41 ×	1·70
4	·85 ×	·60	1·71 ×	1·21	2·13 ×	1·51	2·56 ×	1·81	2·99 ×	2·11
5	1·01 ×	·71	2·02 ×	1·43	2·52 ×	1·78	3·03 ×	2·14	3·53 ×	2·50
6	1·16 ×	·82	2·31 ×	1·64	2·89 ×	2·05	3·47 ×	2·45	4·05 ×	2·86
7	1·30 ×	·92	2·60 ×	1·84	3·25 ×	2·30	3·90 ×	2·76	4·55 ×	3·21
*8	1·44 ×	1·02	2·87 ×	2·03	3·59 ×	2·54	4·31 ×	3·05	5·03 ×	3·55
9	1·57 ×	1·11	3·14 ×	2·22	3·92 ×	2·77	4·71 ×	3·33	5·49 ×	3·88
10	1·70 ×	1·20	3·39 ×	2·40	4·24 ×	3·00	5·09 ×	3·60	5·94 ×	4·20
11	1·82 ×	1·29	3·65 ×	2·58	4·56 ×	3·22	5·47 ×	3·87	6·38 ×	4·51
12	1·95 ×	1·38	3·89 ×	2·75	4·87 ×	3·44	5·84 ×	4·13	6·81 ×	4·82
13	2·07 ×	1·46	4·13 ×	2·92	5·17 ×	3·65	6·20 ×	4·38	7·23 ×	5·11
14	2·18 ×	1·54	4·37 ×	3·09	5·46 ×	3·86	6·55 ×	4·63	7·65 ×	5·41
15	2·30 ×	1·63	4·60 ×	3·25	5·75 ×	4·07	6·90 ×	4·88	8·05 ×	5·69
16	2·41 ×	1·71	4·83 ×	3·41	6·04 ×	4·27	7·24 ×	5·12	8·45 ×	5·98
17	2·53 ×	1·79	5·05 ×	3·57	6·32 ×	4·47	7·58 ×	5·36	8·84 ×	6·25
18	2·64 ×	1·87	5·28 ×	3·73	6·59 ×	4·66	7·91 ×	5·60	9·23 ×	6·53
19	2·75 ×	1·94	5·49 ×	3·88	6·87 ×	4·86	8·24 ×	5·83	9·61 ×	6·80
20	2·85 ×	2·02	5·71 ×	4·04	7·14 ×	5·05	8·56 ×	6·06	9·99 ×	7·06

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of P	40·00 lbs.	640·00 lbs.	1562·50 lbs.	3240·00 lbs.	6002·50 lbs.
$\frac{P}{D}$	·35 cwt.s.	5·71 cwt.s.	13·94 cwt.s.	28·92 cwt.s.	53·59 cwt.s.
Value of P	25·00 lbs.	400·00 lbs.	976·56 lbs.	2025·00 lbs.	3751·56 lbs.
$\frac{P}{D}$	·22 cwt.s.	3·57 cwt.s.	8·71 cwt.s.	18·08 cwt.s.	33·49 cwt.s.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1·6.	IV. Factor $\frac{4}{3}$ .	V. Factor $\frac{8}{7}$ .

\* Example.—Red Pine 8 feet long, 4·31 in. by 3·05 in., with  $8 \times 81 = 648$  lbs. pressure in the direction of the depth, and with  $.5 \times 648 = 324$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{8}{40}$  or  $\frac{1}{5}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 8 feet long, 4·31 in. by 3·05 in., is  $8 \times 81 \times 7·325 = 4746$  lbs.; and in the direction of the breadth, the breaking weight is  $8 \times .5 \times 81 \times 10·36 = 3356$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE IV. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .50 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .707$ .  
The deflections each way of the timber are equal. .... }

Length in feet, clear bearing.	Value of P. 256·0000 lbs.		Value of P. 364·5000 lbs.		Value of P. 500·0000 lbs.		Value of P. 665·5000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	2·2857cwts.		3·2544cwts.		4·4642cwts.		5·9419cwts.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	1·21 × .85		1·36 × .96		1·51 × 1·07		1·66 × 1·17		4·355	6·160
2	2·03 × 1·44		2·28 × 1·62		2·54 × 1·79		2·79 × 1·97		5·180	7·325
3	2·75 × 1·95		3·10 × 2·19		3·44 × 2·43		3·78 × 2·68		5·732	8·107
4	3·41 × 2·41		3·84 × 2·72		4·27 × 3·02		4·70 × 3·32		6·160	8·711
5	4·04 × 2·85		4·54 × 3·21		5·05 × 3·57		5·55 × 3·93		6·513	9·211
6	4·63 × 3·27		5·21 × 3·68		5·79 × 4·09		6·36 × 4·50		6·817	9·641
7	5·20 × 3·67		5·85 × 4·13		6·49 × 4·59		7·14 × 5·05		7·085	10·019
*8	5·74 × 4·06		6·46 × 4·57		7·18 × 5·08		7·90 × 5·58		7·325	10·360
9	6·27 × 4·44		7·06 × 4·99		7·84 × 5·55		8·63 × 6·10		7·544	10·669
10	6·79 × 4·80		7·64 × 5·40		8·49 × 6·00		9·34 × 6·60		7·746	10·954
11	7·29 × 5·16		8·20 × 5·80		9·12 × 6·45		10·03 × 7·09		7·932	11·218
12	7·78 × 5·50		8·76 × 6·19		9·73 × 6·88		10·70 × 7·57		8·107	11·465
13	8·27 × 5·84		9·30 × 6·58		10·33 × 7·31		11·37 × 8·04		8·271	11·697
14	8·74 × 6·18		9·83 × 6·95		10·92 × 7·72		12·02 × 8·50		8·425	11·915
15	9·20 × 6·51		10·35 × 7·32		11·50 × 8·13		12·65 × 8·95		8·572	12·123
16	9·66 × 6·83		10·87 × 7·68		12·07 × 8·54		13·28 × 9·39		8·711	12·320
17	10·11 × 7·15		11·37 × 8·04		12·64 × 8·93		13·90 × 9·83		8·844	12·508
18	10·55 × 7·46		11·87 × 8·39		13·19 × 9·33		14·51 × 10·26		8·972	12·688
19	10·99 × 7·77		12·36 × 8·74		13·73 × 9·71		15·11 × 10·68		9·094	12·861
20	11·42 × 8·07		12·85 × 9·08		14·27 × 10·09		15·70 × 11·10		9·211	13·027

Deflections in the middle for each foot in length.

Value of $\frac{P}{D}$	$\frac{1}{40}$ of an inch.	$\frac{1}{35}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{25}$ of an inch.	See Examples.
Value of $\frac{P}{D}$	10240·00 lbs.	16402·50 lbs.	25000·00 lbs.	36602·50 lbs.	
	91·42cwts.	146·45cwts.	223·21cwts.	326·80cwts.	} Pressure uniform.
Value of $\frac{P}{D}$	6400·00 lbs.	10251·56 lbs.	15625·00 lbs.	22876·56 lbs.	
	57·14cwts.	91·53cwts.	139·50cwts.	204·25cwts.	} Pressure in the middle.

VI.

VII.

VIII.

IX.

\* *Example.*—Red Pine 8 feet long, 7·90 in. by 5·58 in., with  $8 \times 665·5 = 5324$  lbs. pressure in the direction of the depth, and with  $.5 \times 5324 = 2662$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{8}{55}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 8 feet long, 7·90 in. by 5·58 in., is  $8 \times 5·9419 \times 7·325 = 348·16$  cwts.; and in the direction of the breadth, the breaking weight is  $8 \times .5 \times 5·9419 \times 10·36 = 246·23$  cwts.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE IV. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table, Q=.50 P; P=pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .707$ .  
The deflections each way of the timber are equal. ....

Length in feet, clear bearing.	Value of P. 864'0000 lbs.		Value of P. 1098'5000 lbs.		Value of P. 1372'0000 lbs.		Value of P. 1687'5000 lbs.		Value of P. 2048'0000 lbs.	
	7'7142 cwt.s.		9'8080 cwt.s.		12'2500 cwt.s.		15'0669 cwt.s.		18'2857 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	1.81 ×	1.28	1.96 ×	1.39	2.11 ×	1.49	2.26 ×	1.60	2.41 ×	1.71
2	3.05 ×	2.15	3.30 ×	2.33	3.55 ×	2.51	3.81 ×	2.69	4.06 ×	2.87
3	4.13 ×	2.92	4.47 ×	3.16	4.82 ×	3.41	5.16 ×	3.65	5.50 ×	3.89
4	5.12 ×	3.62	5.55 ×	3.92	5.98 ×	4.23	6.40 ×	4.53	6.83 ×	4.83
5	6.06 ×	4.28	6.56 ×	4.64	7.06 ×	5.00	7.57 ×	5.35	8.07 ×	5.71
6	6.94 ×	4.91	7.52 ×	5.32	8.10 ×	5.73	8.68 ×	6.14	9.26 ×	6.55
7	7.79 ×	5.51	8.44 ×	5.97	9.09 ×	6.43	9.74 ×	6.89	10.39 ×	7.35
*8	8.61 ×	6.09	9.33 ×	6.60	10.05 ×	7.11	10.77 ×	7.61	11.49 ×	8.12
9	9.41 ×	6.65	10.19 ×	7.21	10.98 ×	7.76	11.76 ×	8.32	12.55 ×	8.87
10	10.18 ×	7.20	11.03 ×	7.80	11.88 ×	8.40	12.73 ×	9.00	13.58 ×	9.60
11	10.94 ×	7.73	11.85 ×	8.38	12.76 ×	9.02	13.67 ×	9.67	14.59 ×	10.31
12	11.68 ×	8.26	12.65 ×	8.94	13.62 ×	9.63	14.60 ×	10.32	15.57 ×	11.01
13	12.40 ×	8.77	13.43 ×	9.50	14.47 ×	10.23	15.50 ×	10.96	16.53 ×	11.69
14	13.11 ×	9.27	14.20 ×	10.04	15.29 ×	10.81	16.38 ×	11.59	...	...
15	13.80 ×	9.76	14.95 ×	10.57	16.10 ×	11.39	...	...	...	...
16	14.49 ×	10.24	15.70 ×	11.10	16.90 ×	11.95	...	...	...	...
17	15.16 ×	10.72	16.43 ×	11.61	...	...	...	...	...	...
18	15.83 ×	11.19	...	...	...	...	...	...	...	...
19	16.48 ×	11.65	...	...	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{60}$ of an inch.	$\frac{1}{65}$ of an inch.	$\frac{1}{70}$ of an inch.	$\frac{1}{75}$ of an inch.	$\frac{1}{80}$ of an inch.
Value of P D	51840'00 lbs.	71402'50 lbs.	96040'00 lbs.	126562'50 lbs.	163840'00 lbs.
	462'85 cwt.s.	637'52 cwt.s.	857'50 cwt.s.	1130'02 cwt.s.	1462'85 cwt.s.
Value of P D	32400'00 lbs.	44626'56 lbs.	60025'00 lbs.	79101'56 lbs.	102400'00 lbs.
	289'28 cwt.s.	398'45 cwt.s.	535'93 cwt.s.	706'26 cwt.s.	914'28 cwt.s.
	X.	XI.	XII.	XIII.	XIV.

\* *Example.*—Red Pine 8 feet long, 10.77 in. by 7.61 in., with  $8 \times 15.0669 = 120.53$  cwt.s. pressure in the direction of the depth, and with  $.5 \times 120.53 = 60.26$  cwt.s. pressure in the direction of the breadth, deflects each way  $\frac{8}{75}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 8 feet long, 10.77 in. by 7.61 in., is  $8 \times 15.0669 \times 7.325 = 882.92$  cwt.s.; and in the direction of the breadth, the breaking weight is  $8 \times .5 \times 15.0669 \times 10.36 = 624.37$  cwt.s.; the pressures being uniform; or one half of those weights, if the pressures act in the middle.

TABLE IV. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .50 P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal. .... } DEPTH = .707.

Length in feet, clear bearing.	Value of P.		Value of P.		Value of P.		Value of P.		Multipliers to give the breaking weight of every Scantling in the table.	
	2456-5000 lbs.		2916-0000 lbs.		3429-5000 lbs.		4000-0000 lbs.		In the direction of the depth.	In the direction of the breadth.
	21-9330 cwt.		26-0357 cwt.		30-6205 cwt.		35-7142 cwt.			
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	2.57 ×	1.81	2.72 ×	1.92	2.87 ×	2.03	3.02 ×	2.13	4.355	6.160
2	4.31 ×	3.05	4.57 ×	3.23	4.82 ×	3.41	5.08 ×	3.59	5.180	7.325
3	5.85 ×	4.14	6.19 ×	4.38	6.54 ×	4.62	6.88 ×	4.87	5.732	8.107
4	7.26 ×	5.13	7.68 ×	5.43	8.11 ×	5.73	8.54 ×	6.04	6.160	8.711
5	8.58 ×	6.07	9.08 ×	6.42	9.59 ×	6.78	10.09 ×	7.14	6.513	9.211
6	9.84 ×	6.96	10.41 ×	7.36	10.99 ×	7.77	11.57 ×	8.18	6.817	9.641
7	11.04 ×	7.81	11.69 ×	8.27	12.34 ×	8.73	12.99 ×	9.19	7.085	10.019
*8	12.20 ×	8.63	12.92 ×	9.14	13.64 ×	9.65	14.36 ×	10.15	7.325	10.360
9	13.33 ×	9.43	14.12 ×	9.98	14.90 ×	10.54	15.68 ×	11.09	7.544	10.669
10	14.43 ×	10.20	15.28 ×	10.80	16.13 ×	11.40	16.97 ×	12.00	7.746	10.954
11	15.50 ×	10.96	16.41 ×	11.60	...	...	...	...	7.932	11.218
12	16.54 ×	11.70	...	...	...	...	...	...	8.107	11.465
13	...	...	...	...	...	...	...	...	8.271	11.697
14	...	...	...	...	...	...	...	...	8.425	11.915
15	...	...	...	...	...	...	...	...	8.572	12.123
16	...	...	...	...	...	...	...	...	8.711	12.320
17	...	...	...	...	...	...	...	...	8.844	12.508
18	...	...	...	...	...	...	...	...	8.972	12.688
19	...	...	...	...	...	...	...	...	9.094	12.861

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{8}$ of an inch.	$\frac{1}{9}$ of an inch.	$\frac{1}{10}$ of an inch.	$\frac{1}{12}$ of an inch.	See Examples.
Value of P	208802.50 lbs.	262440.00 lbs.	325802.50 lbs.	400000.00 lbs.	Pressure uniform.
D	1864.30 cwt.	2343.21 cwt.	2908.95 cwt.	3571.42 cwt.	
Value of P	130501.56 lbs.	164025.00 lbs.	203626.56 lbs.	250000.00 lbs.	Pressure in the middle.
D	1165.19 cwt.	1464.50 cwt.	1818.09 cwt.	2232.14 cwt.	

XV.

XVI.

XVII.

XVIII.

\* *Example.*—Red Pine 8 feet long, 14.36 in. by 10.15 in., with  $8 \times 35.7142 = 285.71$  cwt. pressure in the direction of the depth, and with  $.5 \times 285.71 = 142.85$  cwt. pressure in the direction of the breadth, defects each way  $\frac{8}{100}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 8 feet long, 14.36 in. by 10.15 in., is  $8 \times 35.7142 \times 7.325 = 2092.85$  cwt.; and in the direction of the breadth, the breaking weight is  $8 \times .5 \times 35.7142 \times 10.36 = 1480$  cwt.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE V.

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .75 P$ ;  $^{\circ}P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal. .... } DEPTH = .866.

Length in feet, clear bearing.	Value of P. 1·0000 lbs.		Value of P. 16·0000 lbs.		Value of P. 39·0625 lbs.		Value of P. 81·0000 lbs.		Value of P. 150·0625 lbs.	
	·0089 cwt.		·1428 cwt.		·3487 cwt.		·7232 cwt.		1·3398 cwt.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	·29 ×	·25	·57 ×	·50	·72 ×	·62	·86 ×	·75	1·00 ×	·87
2	·48 ×	·42	·97 ×	·84	1·21 ×	1·04	1·45 ×	1·25	1·69 ×	1·46
3	·65 ×	·57	1·31 ×	1·13	1·64 ×	1·42	1·96 ×	1·70	2·29 ×	1·98
4	·81 ×	·70	1·62 ×	1·41	2·03 ×	1·76	2·43 ×	2·11	2·84 ×	2·46
5	·96 ×	·83	1·92 ×	1·66	2·40 ×	2·08	2·88 ×	2·49	3·36 ×	2·91
6	1·10 ×	·95	2·20 ×	1·91	2·75 ×	2·38	3·30 ×	2·86	3·85 ×	3·33
7	1·23 ×	1·07	2·47 ×	2·14	3·09 ×	2·67	3·70 ×	3·21	4·32 ×	3·74
8	1·36 ×	1·18	2·73 ×	2·36	3·41 ×	2·96	4·09 ×	3·55	4·78 ×	4·14
*9	1·49 ×	1·29	2·98 ×	2·58	3·73 ×	3·23	4·47 ×	3·87	5·22 ×	4·52
10	1·61 ×	1·40	3·23 ×	2·79	4·03 ×	3·49	4·84 ×	4·19	5·65 ×	4·89
11	1·73 ×	1·50	3·47 ×	3·00	4·33 ×	3·75	5·20 ×	4·50	6·07 ×	5·25
12	1·85 ×	1·60	3·70 ×	3·20	4·63 ×	4·01	5·55 ×	4·81	6·48 ×	5·61
13	1·96 ×	1·70	3·93 ×	3·40	4·91 ×	4·25	5·89 ×	5·10	6·88 ×	5·95
14	2·08 ×	1·80	4·15 ×	3·60	5·19 ×	4·50	6·23 ×	5·40	7·27 ×	6·29
15	2·19 ×	1·89	4·37 ×	3·79	5·47 ×	4·74	6·56 ×	5·68	7·65 ×	6·63
16	2·30 ×	1·99	4·59 ×	3·98	5·74 ×	4·97	6·89 ×	5·96	8·03 ×	6·96
17	2·40 ×	2·08	4·80 ×	4·16	6·01 ×	5·20	7·21 ×	6·24	8·41 ×	7·28
18	2·51 ×	2·17	5·01 ×	4·34	6·27 ×	5·43	7·52 ×	6·51	8·78 ×	7·60
19	2·61 ×	2·26	5·22 ×	4·52	6·53 ×	5·65	7·83 ×	6·78	9·14 ×	7·91
20	2·71 ×	2·35	5·43 ×	4·70	6·78 ×	5·88	8·14 ×	7·05	9·50 ×	8·23

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of P D	40·00 lbs. ·35 cwt.	640·00 lbs. 5·71 cwt.	1562·50 lbs. 13·94 cwt.	3240·00 lbs. 28·92 cwt.	6002·50 lbs. 53·59 cwt.
Value of P D	25·00 lbs. ·22 cwt.	400·00 lbs. 3·57 cwt.	976·56 lbs. 8·71 cwt.	2025·00 lbs. 18·08 cwt.	3751·56 lbs. 33·49 cwt.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1·6.	IV. Factor $\frac{3}{4}$ .	V. Factor $\frac{5}{8}$ .

\* Example.—Red Pine 9 feet long, 5·22 in. by 4·52 in., with  $9 \times 150·0625 = 1350·56$  lbs. pressure in the direction of the depth, and with  $.75 \times 1350·56 = 1012·92$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{9}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 9 feet long, 5·22 in. by 4·52 in., is  $9 \times 150·0625 \times 7·936 = 10718$  lbs.; and in the direction of the breadth, the breaking weight is  $9 \times .75 \times 150·0625 \times 9·164 = 9282$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE V. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .75 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .866.$   
The deflections each way of the timber are equal. .... }

Length in feet, clear bearing.	Value of P. 256·0000 lbs. 2·2857cwts.		Value of P. 364·5000 lbs. 3·2544cwts.		Value of P. 500·0000 lbs. 4·4642cwts.		Value of P. 665·5000 lbs. 5·9419cwts.		Multipliers to give the breaking weight of every Scantling in the table.	
	Depth. Breadth.		Depth. Breadth.		Depth. Breadth.		Depth. Breadth.		In the direction of the depth.	In the direction of the breadth.
1	1·15 × .99		1·29 × 1·12		1·43 × 1·24		1·58 × 1·37		4·582	5·291
2	1·93 × 1·67		2·17 × 1·88		2·41 × 2·09		2·65 × 2·30		5·449	6·292
3	2·62 × 2·27		2·94 × 2·55		3·27 × 2·83		3·60 × 3·12		6·030	6·963
4	3·25 × 2·81		3·65 × 3·16		4·06 × 3·51		4·46 × 3·87		6·480	7·482
5	3·84 × 3·32		4·32 × 3·74		4·80 × 4·15		5·28 × 4·57		6·852	7·912
6	4·40 × 3·81		4·95 × 4·29		5·50 × 4·76		6·05 × 5·24		7·171	8·281
7	4·94 × 4·28		5·56 × 4·81		6·17 × 5·35		6·79 × 5·88		7·453	8·606
8	5·46 × 4·73		6·14 × 5·32		6·82 × 5·91		7·51 × 6·50		7·706	8·898
*9	5·96 × 5·16		6·71 × 5·81		7·46 × 6·46		8·20 × 7·10		7·936	9·164
10	6·45 × 5·59		7·26 × 6·29		8·07 × 6·99		8·87 × 7·69		8·148	9·409
11	6·93 × 6·00		7·80 × 6·75		8·67 × 7·50		9·53 × 8·25		8·345	9·636
12	7·40 × 6·41		8·33 × 7·21		9·25 × 8·01		10·18 × 8·81		8·528	9·848
13	7·86 × 6·80		8·84 × 7·66		9·82 × 8·51		11·80 × 9·36		8·701	10·047
14	8·31 × 7·19		9·34 × 8·09		10·38 × 8·99		11·42 × 9·89		8·863	10·234
15	8·75 × 7·58		9·84 × 8·52		10·94 × 9·47		12·03 × 10·42		9·018	10·413
16	9·18 × 7·95		10·33 × 8·95		11·48 × 9·94		12·62 × 10·93		9·164	10·582
17	9·61 × 8·32		10·81 × 9·36		12·01 × 10·40		13·21 × 11·44		9·304	10·744
18	10·03 × 8·69		11·28 × 9·77		12·54 × 10·86		13·79 × 11·94		9·438	10·898
19	10·44 × 9·04		11·75 × 10·18		13·06 × 11·31		14·36 × 12·44		9·567	11·046
20	10·85 × 9·40		12·21 × 10·58		13·57 × 11·75		14·92 × 12·93		9·690	11·189

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{45}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{55}$ of an inch.	See Examples.
Value of P D	10240·00 lbs. 91·42cwts.	16402·50 lbs. 146·45cwts.	25000·00 lbs. 223·21cwts.	36602·50 lbs. 326·80cwts.	
Value of P D	6400·00 lbs. 57·14cwts.	10251·56 lbs. 91·53cwts.	15625·00 lbs. 139·50cwts.	22876·56 lbs. 204·25cwts.	Pressure uniform. Pressure in the middle.
VI.	VII.	VIII.	IX.		

\* *Example.*—Red Pine 9 feet long, 5·96 in. by 5·16 in., with  $9 \times 256 = 2304$  lbs. pressure in the direction of the depth, and with  $.75 \times 2304 = 1728$  lbs. pressure in the direction of the breadth, deflects each way  $\frac{9}{40}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 9 feet long, 5·96 in. by 5·16 in., is  $9 \times 256 \times 7·936 = 18284$  lbs.; and in the direction of the breadth, the breaking weight is  $9 \times .75 \times 256 \times 9·164 = 15835$  lbs.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE V. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .75 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .866$ .  
The deflections each way of the timber are equal. ....

Length in feet, clear bearing.	Value of P.		Value of P.		Value of P.		Value of P.		Value of P.	
	864·0000 lbs.		1098·5000 lbs.		1372·0000 lbs.		1687·5000 lbs.		2048·0000 lbs.	
	7·7142 cwt.s.		9·8080 cwt.s.		12·2500 cwt.s.		15·0669 cwt.s.		18·2857 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	1·72 ×	1·49	1·87 ×	1·62	2·01 ×	1·74	2·15 ×	1·86	2·30 ×	1·99
2	2·90 ×	2·51	3·14 ×	2·72	3·38 ×	2·93	3·62 ×	3·13	3·86 ×	3·34
3	3·92 ×	3·40	4·25 ×	3·68	4·58 ×	3·96	4·91 ×	4·25	5·23 ×	4·53
4	4·87 ×	4·22	5·27 ×	4·57	5·68 ×	4·92	6·09 ×	5·27	6·49 ×	5·62
5	5·76 ×	4·99	6·24 ×	5·40	6·72 ×	5·82	7·20 ×	6·23	7·68 ×	6·65
6	6·60 ×	5·72	7·15 ×	6·19	7·70 ×	6·67	8·25 ×	7·14	8·80 ×	7·62
7	7·41 ×	6·42	8·03 ×	6·95	8·64 ×	7·48	9·26 ×	8·02	9·88 ×	8·55
8	8·19 ×	7·09	8·87 ×	7·68	9·55 ×	8·27	10·24 ×	8·87	10·92 ×	9·46
*9	8·95 ×	7·75	9·69 ×	8·39	10·44 ×	9·04	11·18 ×	9·68	11·93 ×	10·33
10	9·68 ×	8·38	10·49 ×	9·08	11·29 ×	9·78	12·10 ×	10·48	12·91 ×	11·18
11	10·40 ×	9·01	11·26 ×	9·76	12·13 ×	10·51	13·00 ×	11·26	13·86 ×	12·01
12	11·10 ×	9·61	12·02 ×	10·41	12·94 ×	11·21	13·87 ×	12·02	14·79 ×	12·82
13	11·79 ×	10·21	12·77 ×	11·06	13·75 ×	11·91	14·73 ×	12·76	15·72 ×	13·61
14	12·46 ×	10·79	13·50 ×	11·69	14·54 ×	12·59	15·57 ×	13·49	16·61 ×	14·39
15	13·12 ×	11·36	14·22 ×	12·31	15·31 ×	13·26	16·40 ×	14·20	...	...
16	13·77 ×	11·93	14·92 ×	12·92	16·07 ×	13·91	...	...	...	...
17	14·41 ×	12·48	15·61 ×	13·52	16·82 ×	14·56	...	...	...	...
18	15·04 ×	13·03	16·30 ×	14·11	...	...	...	...	...	...
19	15·67 ×	13·57	16·97 ×	14·70	...	...	...	...	...	...
20	16·28 ×	14·10	...	...	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of $\frac{P}{D}$	$\frac{1}{60}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{20}$ of an inch.
Value of $\frac{P}{D}$	51840·00 lbs.	71402·50 lbs.	96040·00 lbs.	126562·50 lbs.	163840·00 lbs.
$\frac{P}{D}$	462·85 cwt.s.	637·52 cwt.s.	857·50 cwt.s.	1130·02 cwt.s.	1462·85 cwt.s.
Value of $\frac{P}{D}$	32400·00 lbs.	44626·56 lbs.	60025·00 lbs.	79101·56 lbs.	102400·00 lbs.
$\frac{P}{D}$	289·28 cwt.s.	398·45 cwt.s.	535·93 cwt.s.	706·26 cwt.s.	914·28 cwt.s.
	X.	XI.	XII.	XIII.	XIV.

\* *Example.*—Red Pine 9 feet long, 11·93 in. by 10·33 in., with  $9 \times 18·2857 = 164·57$  cwt.s. pressure in the direction of the depth, and with  $.75 \times 164·57 = 123·42$  cwt.s. pressure in the direction of the breadth, deflects each way  $\frac{1}{80}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 9 feet long, 11·93 in. by 10·33 in., is  $9 \times 18·2857 \times 7·936 = 1306·05$  cwt.s.; and in the direction of the breadth, the breaking weight is  $9 \times .75 \times 18·2857 \times 9·164 = 1131·09$  cwt.s.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.

TABLE V. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = .75 P$ ;  $P$  = pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = .866$ .  
The deflections each way of the timber are equal. ....

Length in feet, clear bearing.	Value of P. 2456-5000 lbs.		Value of P. 2916-0000 lbs.		Value of P. 3429-5000 lbs.		Value of P. 4000-0000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	21-9330 cwt.		26-0357 cwt.		30-6205 cwt.		35-7142 cwt.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	2-44 ×	2-11	2-58 ×	2-24	2-73 ×	2-36	2-87 ×	2-48	4-582	5-291
2	4-10 ×	3-55	4-34 ×	3-76	4-58 ×	3-97	4-83 ×	4-18	5-449	6-292
3	5-56 ×	4-81	5-89 ×	5-10	6-21 ×	5-38	6-54 ×	5-66	6-030	6-963
4	6-90 ×	5-97	7-30 ×	6-33	7-71 ×	6-68	8-12 ×	7-03	6-480	7-482
5	8-15 ×	7-06	8-63 ×	7-48	9-11 ×	7-89	9-59 ×	8-31	6-852	7-912
6	9-35 ×	8-10	9-90 ×	8-57	10-45 ×	9-05	11-00 ×	9-53	7-171	8-281
7	10-50 ×	9-09	11-11 ×	9-62	11-73 ×	10-16	12-35 ×	10-69	7-453	8-606
8	11-60 ×	10-05	12-28 ×	10-64	12-97 ×	11-23	13-65 ×	11-82	7-706	8-898
*9	12-67 ×	10-97	13-42 ×	11-62	14-16 ×	12-27	14-91 ×	12-91	7-936	9-164
10	13-71 ×	11-88	14-52 ×	12-58	15-33 ×	13-27	16-13 ×	13-97	8-148	9-409
11	14-73 ×	12-76	15-60 ×	13-51	16-46 ×	14-26	...	...	8-345	9-636
12	15-72 ×	13-62	16-64 ×	14-42	...	...	...	...	8-528	9-848
13	16-70 ×	14-46	...	...	...	...	...	...	8-701	10-047
14	...	...	...	...	...	...	...	...	8-863	10-234
15	...	...	...	...	...	...	...	...	9-018	10-413
16	...	...	...	...	...	...	...	...	9-164	10-582
17	...	...	...	...	...	...	...	...	9-304	10-744
18	...	...	...	...	...	...	...	...	9-438	10-898
19	...	...	...	...	...	...	...	...	9-567	11-046
20	...	...	...	...	...	...	...	...	9-690	11-189

Deflections in the middle for each foot in length.

Value of D of P D	$\frac{1}{85}$ of an inch.	$\frac{1}{60}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{100}$ of an inch.	See Examples.
Value of P D	208802-50 lbs.	262440-00 lbs.	325802-50 lbs.	400000-00 lbs.	
Value of P D	1864-30 cwt.	2343-21 cwt.	2908-95 cwt.	3571-42 cwt.	
Value of P D	130501-56 lbs.	164025-00 lbs.	203626-56 lbs.	250000-00 lbs.	Pressure in the middle.
Value of P D	1165-19 cwt.	1464-50 cwt.	1818-09 cwt.	2232-14 cwt.	

XV.	XVI.	XVII.	XVIII.
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\* *Example.*—Red Pine 9 feet long, 13-42 in. by 11-62 in., with  $9 \times 26-0357 = 234-32$  cwt. pressure in the direction of the depth, and with  $.75 \times 234-32 = 175-74$  cwt. pressure in the direction of the breadth, deflects each way  $\frac{9}{60}$  or  $\frac{1}{10}$  of an inch.

The breaking weight, in the direction of the depth, of Red Pine 9 feet long, 13-42 in. by 11-62 in., is  $9 \times 26-0357 \times 7-936 = 1859-57$  cwt.; and in the direction of the breadth, the breaking weight is  $9 \times .75 \times 26-0357 \times 9-164 = 1610-49$  cwt.; the pressure being uniform in both cases; or one half of those weights, if the pressures act in the middle.



TABLE VI.

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q = P$ ;  $P$  = pressure upon each foot in length; } BREADTH  
The deflections each way of the timber are equal. .... } DEPTH = 1.00.

Length in feet, clear bearing.	Value of P. 1.0000 lbs. ·0089 cwt.s.		Value of P. 16.0000 lbs. ·1428 cwt.s.		Value of P. 39.0625 lbs. ·3487 cwt.s.		Value of P. 81.0000 lbs. ·7232 cwt.s.		Value of P. 150.0625 lbs. 1.3398 cwt.s.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	·28	× ·28	·55	× ·55	·69	× ·69	·83	× ·83	·97	× ·97
2	·47	× ·47	·93	× ·93	1.16	× 1.16	1.40	× 1.40	1.63	× 1.63
3	·63	× ·63	1.26	× 1.26	1.58	× 1.58	1.89	× 1.89	2.21	× 2.21
4	·78	× ·78	1.57	× 1.57	1.96	× 1.96	2.35	× 2.35	2.74	× 2.74
5	·93	× ·93	1.85	× 1.85	2.31	× 2.31	2.78	× 2.78	3.24	× 3.24
6	1.06	× 1.06	2.12	× 2.12	2.65	× 2.65	3.18	× 3.18	3.71	× 3.71
7	1.19	× 1.19	2.38	× 2.38	2.98	× 2.98	3.57	× 3.57	4.17	× 4.17
8	1.32	× 1.32	2.63	× 2.63	3.29	× 3.29	3.95	× 3.95	4.61	× 4.61
9	1.44	× 1.44	2.88	× 2.88	3.60	× 3.60	4.31	× 4.31	5.03	× 5.03
* 10	1.56	× 1.56	3.11	× 3.11	3.89	× 3.89	4.67	× 4.67	5.45	× 5.45
11	1.67	× 1.67	3.34	× 3.34	4.18	× 4.18	5.02	× 5.02	5.85	× 5.85
12	1.78	× 1.78	3.57	× 3.57	4.46	× 4.46	5.35	× 5.35	6.25	× 6.25
13	1.90	× 1.90	3.79	× 3.79	4.74	× 4.74	5.68	× 5.68	6.63	× 6.63
14	2.00	× 2.00	4.01	× 4.01	5.01	× 5.01	6.01	× 6.01	7.01	× 7.01
15	2.11	× 2.11	4.22	× 4.22	5.27	× 5.27	6.33	× 6.33	7.38	× 7.38
16	2.21	× 2.21	4.43	× 4.43	5.54	× 5.54	6.64	× 6.64	7.75	× 7.75
17	2.32	× 2.32	4.63	× 4.63	5.79	× 5.79	6.95	× 6.95	8.11	× 8.11
18	2.42	× 2.42	4.84	× 4.84	6.05	× 6.05	7.26	× 7.26	8.47	× 8.47
19	2.52	× 2.52	5.04	× 5.04	6.30	× 6.30	7.56	× 7.56	8.82	× 8.82
20	2.62	× 2.62	5.24	× 5.24	6.54	× 6.54	7.85	× 7.85	9.16	× 9.16

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{40}$ of an inch.
Value of P D	40.00 lbs. ·35 cwt.s.	640.00 lbs. 5.71 cwt.s.	1562.50 lbs. 13.94 cwt.s.	3240.00 lbs. 28.92 cwt.s.	6002.50 lbs. 53.59 cwt.s.
Value of P D	25.00 lbs. ·22 cwt.s.	400.00 lbs. 3.57 cwt.s.	976.56 lbs. 8.71 cwt.s.	2025.00 lbs. 18.08 cwt.s.	3751.56 lbs. 33.49 cwt.s.
Factors to give the breaking weight.	Column I. Factor 4.	II. Factor 2.	III. Factor 1.6.	IV. Factor $\frac{4}{3}$ .	V. Factor $\frac{3}{2}$ .

\* *Example.*—Red Pine 10 feet long, 4.67 in. by 4.67 in., with  $10 \times 81 = 810$  lbs. pressure in the direction of the depth, and with 810 lbs. pressure in the direction of the breadth, deflects each way  $\frac{1}{40}$  or  $\frac{1}{4}$  of an inch.

The breaking weight, in the direction of the depth, and also of the breadth, of Red Pine 10 feet long, 4.67 in. by 4.67 in., is  $10 \times 81 \times 8.447 \times \frac{4}{3} = 9122$  lbs., the pressure being uniform in both cases; or one half of that weight, viz., 4561 lbs., if the pressures act in the middle.



TABLE VI. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q=P$ ;  $P$ =pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}} = 1.00$ .  
The deflections each way of the timber are equal. ....

Length in feet, clear bearing.	Value of P. 256.0000 lbs.		Value of P. 364.5000 lbs.		Value of P. 500.0000 lbs.		Value of P. 665.5000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	2.2857cwt.		3.2544cwt.		4.4642cwt.		5.9419cwt.		In the direction of the depth.	In the direction of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	1.11 ×	1.11	1.25 ×	1.25	1.38 ×	1.38	1.52 ×	1.52	4.750	4.750
2	1.86 ×	1.86	2.09 ×	2.09	2.33 ×	2.33	2.56 ×	2.56	5.648	5.648
3	2.52 ×	2.52	2.84 ×	2.84	3.15 ×	3.15	3.47 ×	3.47	6.251	6.251
4	3.13 ×	3.13	3.52 ×	3.52	3.91 ×	3.91	4.31 ×	4.31	6.717	6.717
5	3.70 ×	3.70	4.16 ×	4.16	4.63 ×	4.63	5.09 ×	5.09	7.103	7.103
6	4.24 ×	4.24	4.78 ×	4.78	5.31 ×	5.31	5.84 ×	5.84	7.434	7.434
7	4.76 ×	4.76	5.36 ×	5.36	5.96 ×	5.96	6.55 ×	6.55	7.726	7.726
8	5.27 ×	5.27	5.92 ×	5.92	6.58 ×	6.58	7.24 ×	7.24	7.988	7.988
9	5.75 ×	5.75	6.47 ×	6.47	7.19 ×	7.19	7.91 ×	7.91	8.227	8.227
* 10	6.23 ×	6.23	7.00 ×	7.00	7.78 ×	7.78	8.56 ×	8.56	8.447	8.447
11	6.69 ×	6.69	7.52 ×	7.52	8.36 ×	8.36	9.20 ×	9.20	8.650	8.650
12	7.14 ×	7.14	8.03 ×	8.03	8.92 ×	8.92	9.82 ×	9.82	8.840	8.840
13	7.58 ×	7.58	8.53 ×	8.53	9.47 ×	9.47	10.42 ×	10.42	9.019	9.019
14	8.01 ×	8.01	9.01 ×	9.01	10.02 ×	10.02	11.02 ×	11.02	9.188	9.188
15	8.44 ×	8.44	9.49 ×	9.49	10.55 ×	10.55	11.60 ×	11.60	9.348	9.348
16	8.86 ×	8.86	9.96 ×	9.96	11.07 ×	11.07	12.18 ×	12.18	9.500	9.500
17	9.27 ×	9.27	10.43 ×	10.43	11.59 ×	11.59	12.75 ×	12.75	9.645	9.645
18	9.68 ×	9.68	10.88 ×	10.88	12.09 ×	12.09	13.30 ×	13.30	9.784	9.784
19	10.08 ×	10.08	11.34 ×	11.34	12.60 ×	12.60	13.86 ×	13.86	9.917	9.917
20	10.47 ×	10.47	11.78 ×	11.78	13.09 ×	13.09	14.40 ×	14.40	10.045	10.045

Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{40}$ of an inch.	$\frac{1}{35}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{25}$ of an inch.	See Examples.
Value of P D	10240.00 lbs.	16402.50 lbs.	25000.00 lbs.	36602.50 lbs.	Pressure uniform.
	91.42cwt.	146.45cwt.	223.21cwt.	326.80cwt.	
Value of P D	6400.00 lbs.	10251.56 lbs.	15625.00 lbs.	22876.56 lbs.	Pressure in the middle.
	57.14cwt.	91.53cwt.	139.50cwt.	204.25cwt.	
	VI.	VII.	VIII.	IX.	

\* *Example.*—Red Pine 10 feet long, 7.78 in. by 7.78 in., with  $10 \times 500 = 5000$  lbs. pressure in the direction of the depth, and with 5000 lbs. pressure in the direction of the breadth, deflects each way  $\frac{1}{30}$  or  $\frac{1}{25}$  of an inch.

The breaking weight, in the direction of the depth, and also of the breadth, of Red Pine 10 feet long, 7.78 in. by 7.78 in., is  $10 \times 500 \times 8.447 = 42235$  lbs., the pressure being uniform in both cases; or one half of that weight, viz., 21117 lbs., if the pressures act in the middle.

TABLE VI. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q=P$ ;  $P$ =pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}}=1.00$ .  
The deflections each way of the timber are equal. .... }

Length in feet, clear bearing.	Value of P. 864'0000 lbs. 7'7142 cwt.		Value of P. 1098'5000 lbs. 9'8080 cwt.		Value of P. 1372'0000 lbs. 12'2500 cwt.		Value of P. 1687'5000 lbs. 15'0669 cwt.		Value of P. 2048'0000 lbs. 18'2857 cwt.	
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.
1	1.66 ×	1.66	1.80 ×	1.80	1.94 ×	1.94	2.08 ×	2.08	2.21 ×	2.21
2	2.79 ×	2.79	3.03 ×	3.03	3.26 ×	3.26	3.49 ×	3.49	3.72 ×	3.72
3	3.79 ×	3.79	4.10 ×	4.10	4.42 ×	4.42	4.73 ×	4.73	5.05 ×	5.05
4	4.70 ×	4.70	5.09 ×	5.09	5.48 ×	5.48	5.87 ×	5.87	6.26 ×	6.26
5	5.55 ×	5.55	6.02 ×	6.02	6.48 ×	6.48	6.94 ×	6.94	7.40 ×	7.40
6	6.37 ×	6.37	6.90 ×	6.90	7.43 ×	7.43	7.96 ×	7.96	8.49 ×	8.49
7	7.15 ×	7.15	7.74 ×	7.74	8.34 ×	8.34	8.93 ×	8.93	9.53 ×	9.53
8	7.90 ×	7.90	8.56 ×	8.56	9.22 ×	9.22	9.87 ×	9.87	10.53 ×	10.53
9	8.63 ×	8.63	9.35 ×	9.35	10.07 ×	10.07	10.79 ×	10.79	11.51 ×	11.51
* 10	9.34 ×	9.34	10.12 ×	10.12	10.89 ×	10.89	11.67 ×	11.67	12.45 ×	12.45
11	10.03 ×	10.03	10.87 ×	10.87	11.70 ×	11.70	12.54 ×	12.54	13.37 ×	13.37
12	10.71 ×	10.71	11.60 ×	11.60	12.49 ×	12.49	13.38 ×	13.38	14.28 ×	14.28
13	11.37 ×	11.37	12.32 ×	12.32	13.27 ×	13.27	14.21 ×	14.21	15.16 ×	15.16
14	12.02 ×	12.02	13.02 ×	13.02	14.02 ×	14.02	15.02 ×	15.02	16.03 ×	16.03
15	12.66 ×	12.66	13.71 ×	13.71	14.77 ×	14.77	15.82 ×	15.82	16.88 ×	16.88
16	13.29 ×	13.29	14.39 ×	14.39	15.50 ×	15.50	16.61 ×	16.61	...	...
17	13.90 ×	13.90	15.06 ×	15.06	16.22 ×	16.22	...	...	...	...
18	14.51 ×	14.51	15.72 ×	15.72	16.93 ×	16.93	...	...	...	...
19	15.12 ×	15.12	16.38 ×	16.38	...	...	...	...	...	...
20	15.71 ×	15.71	17.02 ×	17.02	...	...	...	...	...	...

Deflections in the middle for each foot in length.

Value of D	$\frac{1}{60}$ of an inch.	$\frac{1}{50}$ of an inch.	$\frac{1}{40}$ of an inch.	$\frac{1}{30}$ of an inch.	$\frac{1}{20}$ of an inch.
Value of P	51840.00 lbs.	71402.50 lbs.	96040.00 lbs.	126562.50 lbs.	163840.00 lbs.
D	462.85 cwt.	637.52 cwt.	857.50 cwt.	1130.02 cwt.	1462.85 cwt.
Value of P	32400.00 lbs.	44626.56 lbs.	60025.00 lbs.	79101.56 lbs.	102400.00 lbs.
D	289.28 cwt.	398.45 cwt.	535.93 cwt.	706.26 cwt.	914.28 cwt.
	X.	XI.	XII.	XIII.	XIV.

\* *Example.*—Red Pine 10 feet long, 10.89 in. by 10.89 in., with  $10 \times 12.25 = 122.5$  cwt. pressure in the direction of the depth, and with 122.5 cwt. pressure in the direction of the breadth, deflects each way  $\frac{1}{60}$  or  $\frac{1}{50}$  of an inch.

The breaking weight, in the direction of the depth, and also of the breadth, of Red Pine 10 feet long, 10.89 in. by 10.89 in., is  $10 \times 12.25 \times 8.447 = 1034.75$  cwt., the pressure being uniform in both cases; or one half of that weight, viz. 517.37 cwt., if the pressures act in the middle.

TABLE VI. *Continued.*

SCANTLINGS of RED PINE when acted upon by two forces P and Q, viz.,  
P in the direction of the depth, Q in the direction of the breadth.

In this table,  $Q=P$ ;  $P$ =pressure upon each foot in length; }  $\frac{\text{BREADTH}}{\text{DEPTH}}=1.00.$   
The deflections each way of the timber are equal. .... }

Length in feet, clear bearing.	Value of P. 2456-5000 lbs.		Value of P. 2916-0000 lbs.		Value of P. 3429-5000 lbs.		Value of P. 4000-0000 lbs.		Multipliers to give the breaking weight of every Scantling in the table.	
	21-9330 cwt.		26-0357 cwt.		30-6205 cwt.		35-7142 cwt.		In the direc- tion of the depth.	In the direc- tion of the breadth.
	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.	Depth.	Breadth.		
1	2-35 X	2-35	2-49 X	2-49	2-63 X	2-63	2-77 X	2-77	4-750	4-750
2	3-96 X	3-96	4-19 X	4-19	4-42 X	4-42	4-66 X	4-66	5-648	5-648
3	5-36 X	5-36	5-68 X	5-68	5-99 X	5-99	6-31 X	6-31	6-251	6-251
4	6-65 X	6-65	7-05 X	7-05	7-44 X	7-44	7-83 X	7-83	6-717	6-717
5	7-87 X	7-87	8-33 X	8-33	8-79 X	8-79	9-26 X	9-26	7-103	7-103
6	9-02 X	9-02	9-55 X	9-55	10-08 X	10-08	10-61 X	10-61	7-434	7-434
7	10-12 X	10-12	10-72 X	10-72	11-32 X	11-32	11-91 X	11-91	7-726	7-726
8	11-19 X	11-19	11-85 X	11-85	12-51 X	12-51	13-17 X	13-17	7-988	7-988
9	12-23 X	12-23	12-94 X	12-94	13-66 X	13-66	14-38 X	14-38	8-227	8-227
* 10	13-23 X	13-23	14-01 X	14-01	14-79 X	14-79	15-56 X	15-56	8-447	8-447
11	14-21 X	14-21	15-05 X	15-05	15-88 X	15-88	16-72 X	16-72	8-650	8-650
12	15-17 X	15-17	16-06 X	16-06	16-95 X	16-95	...	...	8-840	8-840
13	16-11 X	16-11	17-06 X	17-06	...	...	...	...	9-019	9-019
14	17-03 X	17-03	...	...	...	...	...	...	9-188	9-188
15	...	...	...	...	...	...	...	...	9-348	9-348
16	...	...	...	...	...	...	...	...	9-500	9-500
17	...	...	...	...	...	...	...	...	9-645	9-645
18	...	...	...	...	...	...	...	...	9-784	9-784
19	...	...	...	...	...	...	...	...	9-917	9-917
20	...	...	...	...	...	...	...	...	10-045	10-045

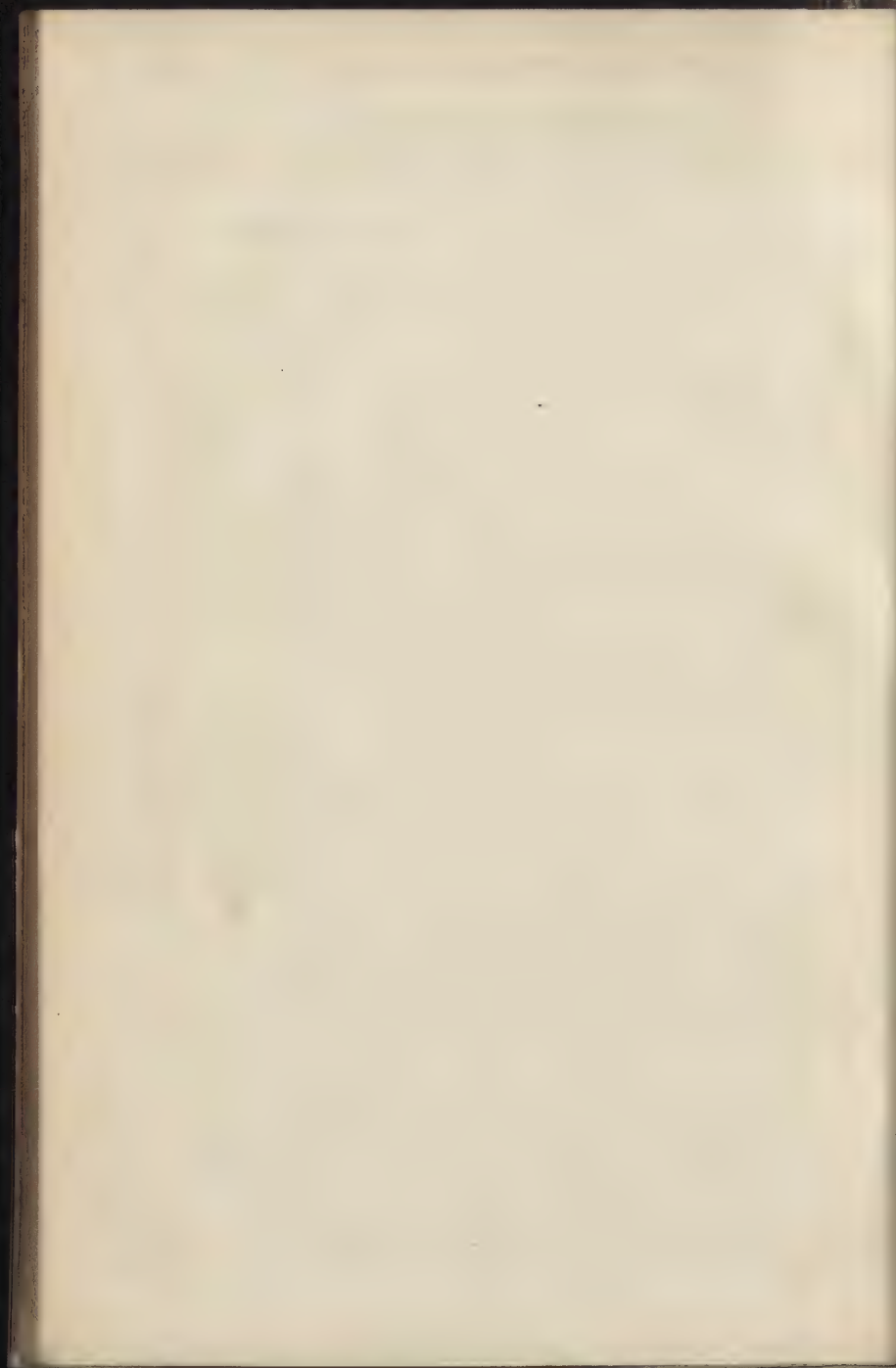
Deflections in the middle for each foot in length.

Value of D.	$\frac{1}{85}$ of an inch.	$\frac{1}{90}$ of an inch.	$\frac{1}{95}$ of an inch.	$\frac{1}{100}$ of an inch.	See Examples.
Value of P	208802-50 lbs.	262440-00 lbs.	325802-50 lbs.	400000-00 lbs.	
D	1864-30 cwt.	2343-21 cwt.	2908-95 cwt.	3571-42 cwt.	
Value of P	130501-56 lbs.	164025-00 lbs.	203626-56 lbs.	250000-00 lbs.	Pressure uniform.
D	1165-19 cwt.	1464-50 cwt.	1818-09 cwt.	2232-14 cwt.	

XV.	XVI.	XVII.	XVIII.
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\* *Example.*—Red Pine 10 feet long, 15-56 in. by 15-56 in., with  $10 \times 35-7142 = 357-14$  cwt. pressure in the direction of the depth, and with 357-14 cwt. pressure in the direction of the breadth, deflects each way  $\frac{1}{100}$  or  $\frac{1}{10}$  of an inch.

The breaking weight, in the direction of the depth, and also of the breadth, of Red Pine 10 feet long, 15-56 in. by 15-56 in., is  $10 \times 35-7142 \times 8-447 = 3016-77$  cwt., the pressure being uniform in both cases; or one half of that weight, viz., 1508-38 cwt., if the pressures act in the middle.





MISCELLANEOUS TABLES,

&c.

TABLE I.

By which may be found the Scantlings of RED PINE, sufficient to carry, when loaded, any given portion of the breaking weight.

\* \* The breaking weight of every scantling in this table is ONE CWT. to the foot, uniformly loaded.

Depth in inches.	LENGTH IN FEET CLEAR BEARING.							
	1	2	3	4	5	6	7	8
	BREADTH IN INCHES.							
3	·0139	·0556	·1250	·2222	·3472	·5000	·6806	·8889
3½	·0102	·0408	·0918	·1633	·2551	·3673	·5000	·6531
4	·0078	·0313	·0703	·1250	·1953	·2813	·3828	·5000
4½	·0062	·0247	·0556	·0988	·1543	·2222	·3025	·3951
5	·0050	·0200	·0450	·0800	·1250	·1800	·2450	·3200
5½	·0041	·0165	·0372	·0661	·1033	·1488	·2025	·2645
6	·0035	·0139	·0313	·0556	·0868	·1250	·1701	·2222
6½	·0030	·0118	·0266	·0473	·0740	·1065	·1450	·1894
7	·0026	·0102	·0230	·0408	·0638	·0918	·1250	·1633
7½	·0022	·0089	·0200	·0356	·0556	·0800	·1089	·1422
*8	·0020	·0078	·0176	·0313	·0488	·0703	·0957	·1250
8½	·0017	·0069	·0156	·0277	·0433	·0623	·0848	·1107
9	·0015	·0062	·0139	·0247	·0386	·0556	·0756	·0988
9½	·0014	·0055	·0125	·0222	·0346	·0499	·0679	·0886
10	·0013	·0050	·0113	·0200	·0313	·0450	·0613	·0800
10½	·0011	·0045	·0102	·0181	·0283	·0408	·0556	·0726
11	·0010	·0041	·0093	·0165	·0258	·0372	·0506	·0661
11½	·0009	·0038	·0085	·0151	·0236	·0340	·0463	·0605
12	·0009	·0035	·0078	·0139	·0217	·0313	·0425	·0556
12½	·0008	·0032	·0072	·0128	·0200	·0288	·0392	·0512
13	·0007	·0030	·0067	·0118	·0185	·0266	·0362	·0473
13½	·0007	·0027	·0062	·0110	·0171	·0247	·0336	·0439
14	·0006	·0026	·0057	·0102	·0159	·0230	·0313	·0408
14½	·0006	·0024	·0054	·0095	·0149	·0214	·0291	·0381
15	·0006	·0022	·0050	·0089	·0139	·0200	·0272	·0356
16	·0005	·0020	·0044	·0078	·0122	·0176	·0239	·0313
17	·0004	·0017	·0039	·0069	·0108	·0156	·0212	·0277
18	·0004	·0015	·0035	·0062	·0096	·0139	·0189	·0247
19	·0003	·0014	·0031	·0055	·0087	·0125	·0170	·0222
20	·0003	·0013	·0028	·0050	·0078	·0113	·0153	·0200

\* *Example.*—The greatest weight, uniformly loaded, upon a Red Pine joist 8 inches deep and 8 feet long, is 3 cwt. to the foot; then if 6 times that weight be the breaking weight to the foot, the breadth of the joist should be  $6 \times 3 \times \cdot 1250 = 2\cdot25$  inches.

By Table II. page 128, the deflection of a joist 8 inches deep and 8 feet long, uniformly loaded with one-sixth of the breaking weight, is  $\frac{4}{6} \times \cdot 263 = \cdot 21$  of an inch.

TABLE I. *Continued.*

By which may be found the Scantlings of RED PINE, sufficient to carry, when loaded, any given portion of the breaking weight.

\* \* \* The breaking weight of every scantling in this table, is ONE CWT. to the foot, uniformly loaded.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	9	10	11	12	13	14	15	16
	BREADTH IN INCHES.							
3	1·1250	1·3889	1·6806	2·0000	2·3472	2·7222	3·1250	3·5556
3½	·8265	1·0204	1·2347	1·4694	1·7245	2·0000	2·2959	2·6122
4	·6328	·7813	·9453	1·1250	1·3203	1·5313	1·7578	2·0000
4½	·5000	·6173	·7469	·8889	1·0432	1·2099	1·3889	1·5802
5	·4050	·5000	·6050	·7200	·8450	·9800	1·1250	1·2800
5½	·3347	·4132	·5000	·5950	·6984	·8099	·9297	1·0578
6	·2813	·3472	·4201	·5000	·5868	·6806	·7812	·8889
6½	·2396	·2959	·3580	·4260	·5000	·5799	·6657	·7574
7	·2066	·2551	·3087	·3673	·4311	·5000	·5740	·6531
7½	·1800	·2222	·2689	·3200	·3756	·4356	·5000	·5689
8	·1582	·1953	·2363	·2813	·3301	·3828	·4395	·5000
8½	·1401	·1730	·2093	·2491	·2924	·3391	·3893	·4429
9	·1250	·1543	·1867	·2222	·2608	·3025	·3472	·3951
9½	·1122	·1385	·1676	·1994	·2341	·2715	·3116	·3546
10	·1013	·1250	·1513	·1800	·2113	·2450	·2813	·3200
10½	·0918	·1134	·1372	·1633	·1916	·2222	·2551	·2903
11	·0837	·1033	·1250	·1488	·1746	·2025	·2324	·2644
11½	·0766	·0945	·1144	·1361	·1597	·1853	·2127	·2420
12	·0703	·0868	·1050	·1250	·1467	·1701	·1953	·2222
12½	·0648	·0800	·0968	·1152	·1352	·1568	·1800	·2048
13	·0599	·0740	·0895	·1065	·1250	·1450	·1664	·1893
13½	·0556	·0686	·0830	·0988	·1159	·1344	·1543	·1756
* 14	·0517	·0638	·0772	·0918	·1078	·1250	·1435	·1633
14½	·0482	·0595	·0719	·0856	·1005	·1165	·1338	·1522
15	·0450	·0556	·0672	·0800	·0939	·1089	·1250	·1422
16	·0396	·0488	·0591	·0703	·0825	·0957	·1099	·1250
17	·0350	·0433	·0523	·0623	·0731	·0848	·0973	·1107
18	·0313	·0386	·0467	·0556	·0652	·0756	·0868	·0988
19	·0280	·0346	·0419	·0499	·0585	·0679	·0779	·0886
20	·0253	·0313	·0378	·0450	·0528	·0613	·0703	·0800

\* *Example.*—The greatest weight, uniformly loaded, upon a Red Pine beam 14 inches deep and 15 feet long, is 20 cwts. to the foot; then if 4 times that weight be the breaking weight to the foot, the breadth of the beam should be  $4 \times 20 \times \cdot 1435 = 11\cdot48$  inches.

By Table II. page 129, the deflection of a Red Pine beam 14 inches deep and 15 feet long, uniformly loaded with one-fourth of the breaking weight, is ·528 of an inch.

TABLE I. *Continued.*

By which may be found the Scantlings of RED PINE, sufficient to carry, when loaded, any given portion of the breaking weight.

\* \* The breaking weight of every scantling in this table, is ONE CWT. to the foot, uniformly loaded.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	17	18	19	20	21	22	23	24
	BREADTH IN INCHES.							
3	4.0140	4.5000	5.0139	5.5556	6.1250	6.7222	7.3472	8.0000
3½	2.9490	3.3061	3.6837	4.0816	4.5000	4.9388	5.3980	5.8775
4	2.2578	2.5313	2.8203	3.1250	3.4453	3.7813	4.1328	4.5000
4½	1.7840	2.0000	2.2284	2.4691	2.7222	2.9877	3.2654	3.5556
5	1.4450	1.6200	1.8050	2.0000	2.2050	2.4200	2.6450	2.8800
5½	1.1942	1.3388	1.4917	1.6529	1.8223	2.0000	2.1860	2.3801
6	1.0035	1.1250	1.2535	1.3889	1.5312	1.6806	1.8368	2.0000
6½	.8550	.9586	1.0681	1.1834	1.3047	1.4320	1.5651	1.7041
7	.7372	.8265	.9209	1.0204	1.1250	1.2347	1.3495	1.4694
7½	.6422	.7200	.8022	.8889	.9800	1.0756	1.1756	1.2800
8	.5645	.6328	.7051	.7813	.8613	.9453	1.0332	1.1250
8½	.5000	.5606	.6246	.6920	.7630	.8374	.9152	.9965
9	.4460	.5000	.5571	.6173	.6806	.7469	.8164	.8889
9½	.4003	.4487	.5000	.5540	.6108	.6704	.7327	.7978
10	.3613	.4050	.4513	.5000	.5513	.6050	.6613	.7200
10½	.3277	.3673	.4093	.4535	.5000	.5488	.5998	.6531
* 11	.2986	.3347	.3729	.4132	.4556	.5000	.5465	.5950
11½	.2732	.3062	.3412	.3781	.4168	.4575	.5000	.5444
12	.2509	.2813	.3134	.3472	.3828	.4201	.4592	.5000
12½	.2312	.2592	.2888	.3200	.3528	.3872	.4232	.4608
13	.2138	.2396	.2670	.2959	.3262	.3580	.3913	.4260
13½	.1982	.2222	.2476	.2744	.3025	.3320	.3628	.3951
14	.1843	.2066	.2302	.2551	.2813	.3087	.3374	.3673
14½	.1718	.1926	.2146	.2378	.2622	.2878	.3145	.3425
15	.1606	.1800	.2006	.2222	.2450	.2689	.2939	.3200
16	.1411	.1582	.1763	.1953	.2153	.2363	.2583	.2813
17	.1250	.1401	.1561	.1730	.1907	.2093	.2288	.2491
18	.1115	.1250	.1393	.1543	.1701	.1867	.2041	.2222
19	.1001	.1122	.1250	.1385	.1527	.1676	.1832	.1994
20	.0903	.1013	.1128	.1250	.1378	.1513	.1653	.1800

\* *Example.*—The greatest weight, uniformly loaded, upon a Red Pine joist 11 inches deep and 18 feet long, is 1.75 cwt. to the foot; then if 5 times that weight be the breaking weight to the foot, the breadth of the joist should be  $5 \times 1.75 \times .3347 = 2.93$  inches.

By Table II. page 130, the deflection of a Red Pine joist 11 inches deep and 18 feet long, uniformly loaded with one-fifth of the breaking weight, is  $\frac{4}{3} \times .968 = .774$  of an inch.



TABLE I. *Continued.*

By which may be found the Scantlings of RED PINE, sufficient to carry, when loaded, any given portion of the breaking weight.

\* \* The breaking weight of every scantling in this table, is ONE CWT. to the foot, uniformly loaded.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	25	26	27	28	29	30	31	32
BREADTH IN INCHES.								
3	8·6806	9·3889	10·1250	10·8889	11·6806	12·5000	13·3472	14·2222
3½	6·3776	6·8980	7·4387	8·0000	8·5816	9·1837	9·8061	10·4489
4	4·8828	5·2812	5·6953	6·1250	6·5703	7·0312	7·5078	8·0000
4½	3·8580	4·1728	4·5000	4·8395	5·1914	5·5556	5·9321	6·3210
5	3·1250	3·3800	3·6450	3·9200	4·2050	4·5000	4·8050	5·1200
5½	2·5826	2·7934	3·0124	3·2397	3·4752	3·7190	3·9711	4·2314
6	2·1701	2·3472	2·5313	2·7222	2·9201	3·1250	3·3368	3·5556
6½	1·8491	2·0000	2·1568	2·3195	2·4882	2·6627	2·8432	3·0296
7	1·5944	1·7245	1·8597	2·0000	2·1454	2·2959	2·4515	2·6122
7½	1·3889	1·5022	1·6200	1·7422	1·8689	2·0000	2·1356	2·2756
8	1·2207	1·3203	1·4238	1·5313	1·6426	1·7578	1·8770	2·0000
8½	1·0813	1·1696	1·2612	1·3564	1·4550	1·5571	1·6626	1·7716
9	·9645	1·0432	1·1250	1·2099	1·2978	1·3889	1·4830	1·5802
9½	·8657	·9363	1·0097	1·0859	1·1648	1·2465	1·3310	1·4182
10	·7813	·8450	·9113	·9800	1·0513	1·1250	1·2013	1·2800
10½	·7086	·7664	·8265	·8889	·9535	1·0204	1·0896	1·1610
11	·6457	·6984	·7531	·8099	·8688	·9297	·9928	1·0578
11½	·5907	·6389	·6890	·7410	·7949	·8507	·9083	·9679
12	·5425	·5868	·6328	·6806	·7300	·7812	·8342	·8889
12½	·5000	·5408	·5832	·6272	·6728	·7200	·7688	·8192
13	·4623	·5000	·5392	·5799	·6220	·6657	·7108	·7574
13½	·4287	·4637	·5000	·5377	·5768	·6173	·6591	·7023
14	·3986	·4311	·4649	·5000	·5364	·5740	·6129	·6531
14½	·3716	·4019	·4334	·4661	·5000	·5351	·5713	·6088
* 15	·3472	·3756	·4050	·4356	·4672	·5000	·5339	·5689
16	·3052	·3301	·3560	·3828	·4106	·4395	·4692	·5000
17	·2703	·2924	·3153	·3391	·3638	·3893	·4157	·4429
18	·2411	·2608	·2813	·3025	·3245	·3472	·3708	·3951
19	·2164	·2341	·2524	·2715	·2912	·3116	·3328	·3546
20	·1953	·2113	·2278	·2450	·2628	·2813	·3003	·3200

\* *Example.*—The greatest weight, uniformly loaded, upon a Red Pine beam 15 inches deep and 25 feet long, is, including always the weight of the beam, 10 cwts. to the foot; then if 4 times that weight be the breaking weight to the foot, the breadth of the beam should be  $4 \times 10 \times \cdot 3472 = 13\cdot89$  inches.

By Table II. page 131, the deflection of a Red Pine beam 15 inches deep and 25 feet long, uniformly loaded with one-fourth of the breaking weight, is 1·37 inches.

TABLE II.

DEFLECTION of RED PINE Scantlings, of any breadth, when uniformly loaded with one-fourth of the breaking weight.

\* \* When one-fourth of the breaking weight is suspended from the middle, multiply the deflections in this table by  $\cdot 8$ .

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	1	2	3	4	5	6	7	8
	DEFLECTION IN INCHES.							
3	$\cdot 011$	$\cdot 044$	$\cdot 099$	$\cdot 175$	$\cdot 274$	$\cdot 394$	$\cdot 537$	$\cdot 701$
$3\frac{1}{2}$	$\cdot 009$	$\cdot 038$	$\cdot 085$	$\cdot 150$	$\cdot 235$	$\cdot 338$	$\cdot 460$	$\cdot 601$
4	$\cdot 008$	$\cdot 033$	$\cdot 074$	$\cdot 131$	$\cdot 205$	$\cdot 296$	$\cdot 403$	$\cdot 526$
$4\frac{1}{2}$	$\cdot 007$	$\cdot 029$	$\cdot 066$	$\cdot 117$	$\cdot 183$	$\cdot 263$	$\cdot 358$	$\cdot 468$
5	$\cdot 007$	$\cdot 026$	$\cdot 059$	$\cdot 105$	$\cdot 164$	$\cdot 237$	$\cdot 322$	$\cdot 421$
$5\frac{1}{2}$	$\cdot 006$	$\cdot 024$	$\cdot 054$	$\cdot 096$	$\cdot 149$	$\cdot 215$	$\cdot 293$	$\cdot 383$
6	$\cdot 005$	$\cdot 022$	$\cdot 049$	$\cdot 088$	$\cdot 137$	$\cdot 197$	$\cdot 268$	$\cdot 351$
$6\frac{1}{2}$	$\cdot 005$	$\cdot 020$	$\cdot 046$	$\cdot 081$	$\cdot 126$	$\cdot 182$	$\cdot 248$	$\cdot 324$
7	$\cdot 005$	$\cdot 019$	$\cdot 042$	$\cdot 075$	$\cdot 117$	$\cdot 169$	$\cdot 230$	$\cdot 301$
$7\frac{1}{2}$	$\cdot 004$	$\cdot 018$	$\cdot 039$	$\cdot 070$	$\cdot 110$	$\cdot 158$	$\cdot 215$	$\cdot 281$
*8	$\cdot 004$	$\cdot 016$	$\cdot 037$	$\cdot 066$	$\cdot 103$	$\cdot 148$	$\cdot 201$	$\cdot 263$
$8\frac{1}{2}$	$\cdot 004$	$\cdot 015$	$\cdot 035$	$\cdot 062$	$\cdot 097$	$\cdot 139$	$\cdot 190$	$\cdot 248$
9	$\cdot 004$	$\cdot 015$	$\cdot 033$	$\cdot 058$	$\cdot 091$	$\cdot 132$	$\cdot 179$	$\cdot 234$
$9\frac{1}{2}$	$\cdot 003$	$\cdot 014$	$\cdot 031$	$\cdot 055$	$\cdot 087$	$\cdot 125$	$\cdot 170$	$\cdot 221$
10	$\cdot 003$	$\cdot 013$	$\cdot 030$	$\cdot 053$	$\cdot 082$	$\cdot 118$	$\cdot 161$	$\cdot 210$
$10\frac{1}{2}$	$\cdot 003$	$\cdot 013$	$\cdot 028$	$\cdot 050$	$\cdot 078$	$\cdot 113$	$\cdot 153$	$\cdot 200$
11	$\cdot 003$	$\cdot 012$	$\cdot 027$	$\cdot 048$	$\cdot 075$	$\cdot 108$	$\cdot 146$	$\cdot 191$
$11\frac{1}{2}$	$\cdot 003$	$\cdot 011$	$\cdot 026$	$\cdot 046$	$\cdot 071$	$\cdot 103$	$\cdot 140$	$\cdot 183$
12	$\cdot 003$	$\cdot 011$	$\cdot 025$	$\cdot 044$	$\cdot 068$	$\cdot 099$	$\cdot 134$	$\cdot 175$
$12\frac{1}{2}$	$\cdot 003$	$\cdot 011$	$\cdot 024$	$\cdot 042$	$\cdot 066$	$\cdot 095$	$\cdot 129$	$\cdot 168$
13	$\cdot 003$	$\cdot 010$	$\cdot 023$	$\cdot 040$	$\cdot 063$	$\cdot 091$	$\cdot 124$	$\cdot 162$
$13\frac{1}{2}$	$\cdot 002$	$\cdot 010$	$\cdot 022$	$\cdot 039$	$\cdot 061$	$\cdot 088$	$\cdot 119$	$\cdot 156$
14	$\cdot 002$	$\cdot 009$	$\cdot 021$	$\cdot 038$	$\cdot 059$	$\cdot 085$	$\cdot 115$	$\cdot 150$
$14\frac{1}{2}$	$\cdot 002$	$\cdot 009$	$\cdot 020$	$\cdot 036$	$\cdot 057$	$\cdot 082$	$\cdot 111$	$\cdot 145$
15	$\cdot 002$	$\cdot 009$	$\cdot 020$	$\cdot 035$	$\cdot 055$	$\cdot 079$	$\cdot 107$	$\cdot 140$
16	$\cdot 002$	$\cdot 008$	$\cdot 019$	$\cdot 033$	$\cdot 051$	$\cdot 074$	$\cdot 101$	$\cdot 132$
17	$\cdot 002$	$\cdot 008$	$\cdot 017$	$\cdot 031$	$\cdot 048$	$\cdot 070$	$\cdot 095$	$\cdot 124$
18	$\cdot 002$	$\cdot 007$	$\cdot 016$	$\cdot 029$	$\cdot 046$	$\cdot 066$	$\cdot 090$	$\cdot 117$
19	$\cdot 002$	$\cdot 007$	$\cdot 016$	$\cdot 028$	$\cdot 043$	$\cdot 062$	$\cdot 085$	$\cdot 111$
20	$\cdot 002$	$\cdot 007$	$\cdot 015$	$\cdot 026$	$\cdot 041$	$\cdot 059$	$\cdot 081$	$\cdot 105$

\* *Example.*—A Red Pine joist 8 inches deep and 8 feet long, uniformly loaded with one-fourth of the breaking weight, deflects in the middle  $\cdot 263$  of an inch; the same joist uniformly loaded with one-fifth of the breaking weight, deflects  $\frac{4}{5} \times \cdot 263 = \cdot 210$  of an inch; with one-sixth of the breaking weight, the deflection is  $\frac{2}{3} \times \cdot 263 = \cdot 175$  of an inch; and so on.

TABLE II. *Continued.*

DEFLECTION of RED PINE Scantlings, of any breadth, when uniformly loaded with one-fourth of the breaking weight.

\*\* When one-fourth of the breaking weight is suspended from the middle, multiply the deflections in this table by .8.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	9	10	11	12	13	14	15	16
	DEFLECTION IN INCHES.							
3	.888	1.096	1.326	1.578	1.852	2.148	2.465	2.805
3½	.761	.939	1.136	1.352	1.587	1.841	2.113	2.404
4	.666	.822	.994	1.183	1.389	1.611	1.849	2.104
4½	.592	.730	.884	1.052	1.234	1.432	1.644	1.870
5	.533	.657	.795	.947	1.111	1.289	1.479	1.683
5½	.484	.598	.723	.861	1.010	1.171	1.345	1.530
6	.444	.548	.663	.789	.926	1.074	1.233	1.402
6½	.410	.506	.612	.728	.855	.991	1.138	1.295
7	.380	.470	.568	.676	.794	.920	1.057	1.202
7½	.355	.438	.530	.631	.741	.859	.986	1.122
8	.333	.411	.497	.592	.694	.805	.924	1.052
8½	.313	.387	.468	.557	.654	.758	.870	.990
9	.296	.365	.442	.526	.617	.716	.822	.935
9½	.280	.346	.419	.498	.585	.678	.779	.886
10	.266	.329	.398	.473	.556	.644	.740	.841
10½	.254	.313	.379	.451	.529	.614	.704	.801
11	.242	.299	.362	.430	.505	.586	.672	.765
11½	.232	.286	.346	.412	.483	.560	.643	.732
12	.222	.274	.331	.394	.463	.537	.616	.701
12½	.213	.263	.318	.379	.444	.515	.592	.673
13	.205	.253	.306	.364	.427	.496	.569	.647
13½	.197	.244	.295	.351	.412	.477	.548	.623
*14	.190	.235	.284	.338	.397	.460	.528	.601
14½	.184	.227	.274	.326	.383	.444	.510	.580
15	.178	.219	.265	.316	.370	.430	.493	.561
16	.166	.205	.249	.296	.347	.403	.462	.526
17	.157	.193	.234	.278	.327	.379	.435	.495
18	.148	.183	.221	.263	.309	.358	.411	.468
19	.140	.173	.209	.249	.292	.339	.389	.443
20	.133	.164	.199	.237	.278	.322	.370	.421

\* *Example.*—A Red Pine beam 14 inches deep and 15 feet long, uniformly loaded with one-fourth of the breaking weight, deflects in the middle .528 of an inch; the same beam uniformly loaded with one-fifth of the breaking weight, deflects  $\frac{4}{5} \times .528 = .422$  of an inch.

If one-fourth of the breaking weight be suspended from the middle, the deflection is  $.8 \times .528 = .422$  of an inch; if one-fifth of the breaking weight be so suspended, the deflection is  $.8 \times \frac{4}{5} \times .528 = .338$  of an inch; and so on.



TABLE II. *Continued.*

DEFLECTION of RED PINE Scantlings, of any breadth, when uniformly loaded with one-fourth of the breaking weight.

\* \* When one-fourth of the breaking weight is suspended from the middle, multiply the deflections in this table by '8.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	17	18	19	20	21	22	23	24
	DEFLECTION IN INCHES.							
3	3·167	3·550	3·955	4·383	4·832	5·303	5·796	6·311
3½	2·714	3·043	3·390	3·757	4·142	4·545	4·968	5·409
4	2·375	2·663	2·967	3·287	3·624	3·977	4·347	4·733
4½	2·111	2·367	2·637	2·922	3·221	3·535	3·864	4·207
5	1·900	2·130	2·373	2·630	2·899	3·182	3·478	3·787
5½	1·727	1·936	2·157	2·391	2·636	2·893	3·162	3·442
6	1·583	1·775	1·978	2·191	2·416	2·652	2·898	3·156
6½	1·461	1·638	1·826	2·023	2·230	2·448	2·675	2·913
7	1·357	1·521	1·695	1·879	2·071	2·273	2·484	2·705
7½	1·267	1·420	1·582	1·753	1·933	2·121	2·318	2·524
8	1·187	1·331	1·483	1·644	1·812	1·989	2·174	2·367
8½	1·118	1·253	1·396	1·547	1·705	1·872	2·046	2·227
9	1·056	1·183	1·318	1·461	1·611	1·768	1·932	2·104
9½	1·000	1·121	1·249	1·384	1·526	1·675	1·830	1·993
10	·950	1·065	1·187	1·315	1·450	1·591	1·739	1·893
10½	·905	1·014	1·130	1·252	1·381	1·515	1·656	1·803
* 11	·864	·968	1·079	1·195	1·318	1·446	1·581	1·721
11½	·826	·926	1·032	1·143	1·260	1·383	1·512	1·646
12	·792	·888	·989	1·096	1·208	1·326	1·449	1·578
12½	·760	·852	·949	1·052	1·160	1·272	1·391	1·515
13	·731	·819	·913	1·011	1·115	1·224	1·338	1·456
13½	·704	·789	·879	·974	1·074	1·178	1·288	1·402
14	·679	·761	·848	·939	1·035	1·136	1·242	1·352
14½	·655	·735	·818	·907	1·000	1·097	1·199	1·306
15	·633	·710	·791	·877	·966	1·061	1·159	1·262
16	·594	·666	·742	·822	·906	·994	1·087	1·183
17	·559	·626	·698	·773	·853	·936	1·023	1·114
18	·528	·592	·659	·730	·805	·884	·966	1·052
19	·500	·561	·625	·692	·763	·837	·915	·997
20	·475	·533	·593	·657	·725	·795	·869	·947

\* *Example.*—A Red Pine joist 11 inches deep and 18 feet long, uniformly loaded with one-fourth of the breaking weight, deflects in the middle ·968 of an inch; the same joist, uniformly loaded with one-fifth of the breaking weight, deflects  $\frac{4}{5} \times \cdot 968 = \cdot 774$  of an inch.



TABLE II. *Continued.*

DEFLECTION of RED PINE Scantlings, of any breadth, when uniformly loaded with one-fourth of the breaking weight.

\* \* When one-fourth of the breaking weight is suspended from the middle, multiply the deflections in this table by .8.

Depth in inches.	LENGTH IN FEET, CLEAR BEARING.							
	25	26	27	28	29	30	31	32
DEFLECTION IN INCHES.								
3	6·848	7·407	7·987	8·590	9·215	9·861	10·529	11·220
3½	5·870	6·349	6·846	7·363	7·898	8·452	9·025	9·617
4	5·136	5·555	5·991	6·443	6·911	7·396	7·897	8·415
4½	4·565	4·938	5·325	5·727	6·143	6·574	7·020	7·480
5	4·109	4·444	4·792	5·154	5·529	5·917	6·318	6·732
5½	3·735	4·040	4·357	4·685	5·026	5·379	5·743	6·120
6	3·424	3·703	3·994	4·295	4·608	4·931	5·265	5·610
6½	3·161	3·419	3·687	3·965	4·253	4·551	4·860	5·178
7	2·935	3·174	3·423	3·681	3·949	4·226	4·513	4·808
7½	2·739	2·963	3·195	3·436	3·686	3·944	4·212	4·488
8	2·568	2·778	2·995	3·221	3·455	3·698	3·949	4·207
8½	2·417	2·614	2·819	3·032	3·252	3·480	3·716	3·960
9	2·283	2·469	2·663	2·863	3·072	3·287	3·510	3·740
9½	2·163	2·339	2·522	2·713	2·910	3·114	3·325	3·543
10	2·054	2·222	2·396	2·577	2·764	2·958	3·159	3·366
10½	1·957	2·116	2·282	2·454	2·633	2·817	3·008	3·206
11	1·868	2·020	2·178	2·343	2·513	2·689	2·872	3·060
11½	1·786	1·932	2·084	2·241	2·404	2·572	2·747	2·927
12	1·712	1·852	1·997	2·148	2·304	2·465	2·632	2·805
12½	1·644	1·778	1·917	2·062	2·212	2·367	2·527	2·693
13	1·580	1·709	1·843	1·982	2·126	2·276	2·430	2·589
13½	1·522	1·646	1·775	1·909	2·048	2·191	2·340	2·493
14	1·467	1·587	1·712	1·841	1·975	2·113	2·256	2·404
14½	1·417	1·532	1·653	1·777	1·906	2·040	2·179	2·321
* 15	1·370	1·481	1·598	1·718	1·843	1·972	2·106	2·244
16	1·284	1·389	1·498	1·611	1·728	1·849	1·974	2·104
17	1·208	1·307	1·410	1·516	1·626	1·740	1·858	1·980
18	1·141	1·234	1·331	1·432	1·536	1·644	1·755	1·870
19	1·081	1·170	1·261	1·356	1·455	1·557	1·663	1·772
20	1·027	1·111	1·198	1·289	1·382	1·479	1·579	1·683

\* *Example.*—A Red Pine beam 15 inches deep and 25 feet long, uniformly loaded with one-fourth of the breaking weight, deflects in the middle 1·370 inches; if one one-fourth of the breaking weight be suspended from the middle, the deflection is  $.8 \times 1·370 = 1·096$  inches.

TABLE III.

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, &c.; the BREADTH being  $1\frac{1}{2}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	15·62	20·79	27·00	34·32	42·87	52·73	64·00	76·76	91·12	107·17
	DEPTH IN INCHES.									
1	·39	·43	·47	·51	·55	·59	·63	·67	·71	·75
2	·79	·87	·95	1·02	1·10	1·18	1·26	1·34	1·42	1·50
3	1·18	1·30	1·42	1·54	1·65	1·77	1·89	2·01	2·13	2·25
4	1·58	1·73	1·89	2·05	2·21	2·36	2·52	2·68	2·84	2·99
5	1·97	2·17	2·36	2·56	2·76	2·95	3·15	3·35	3·55	3·74
*6	2·36	2·60	2·84	3·07	3·31	3·55	3·78	4·02	4·25	4·49
7	2·76	3·03	3·31	3·58	3·86	4·14	4·41	4·69	4·96	5·24
8	3·15	3·47	3·78	4·10	4·41	4·73	5·04	5·36	5·67	5·99
9	3·55	3·90	4·25	4·61	4·96	5·32	5·67	6·03	6·38	6·74
10	3·94	4·33	4·73	5·12	5·52	5·91	6·30	6·70	7·09	7·49
11	4·33	4·77	5·20	5·63	6·07	6·50	6·93	7·37	7·80	8·23
12	4·73	5·20	5·67	6·15	6·62	7·09	7·56	8·04	8·51	8·98
13	5·12	5·63	6·15	6·66	7·17	7·68	8·19	8·71	9·22	9·73
14	5·52	6·07	6·62	7·17	7·72	8·27	8·82	9·38	9·93	10·48
15	5·91	6·50	7·09	7·68	8·27	8·86	9·45	10·05	10·64	11·23
16	6·30	6·93	7·56	8·19	8·82	9·45	10·09	10·72	11·35	11·98
17	6·70	7·37	8·04	8·71	9·38	10·05	10·72	11·39	12·05	12·72
18	7·09	7·80	8·51	9·22	9·93	10·64	11·35	12·05	12·76	13·47
19	7·49	8·23	8·98	9·73	10·48	11·23	11·98	12·72	13·47	14·22
20	7·88	8·67	9·45	10·24	11·03	11·82	12·61	13·39	14·18	14·97

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

13·34	12·13	11·12	10·26	9·53	8·90	8·34	7·85	7·41	7·02
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\* *Example*.—If the weight upon a ceiling joist 6 feet long, 3·07 in. by  $1\frac{1}{2}$  in., be 34·32 lbs. to the foot, the deflection in the middle is  $\frac{6}{40}$  of an inch; with one-half of that weight, or 17·16 lbs. to the foot, the deflection is  $\frac{6}{80}$  or  $\frac{3}{40}$  of an inch; with one-third of the same weight, or 11·44 lbs. to the foot, the deflection is  $\frac{6}{120}$  or  $\frac{1}{20}$  of an inch; and so on, the deflection varying according as the weight.

The breaking weight of a Red Pine ceiling joist 6 feet long, 3·07 in. by  $1\frac{1}{2}$  in., is  $6 \times 34·32 \times 10·26 = 2112$  lbs. uniformly loaded, or 1056 lbs. suspended from the middle.

The weight of a superficial foot of laths and hair mortar, may be estimated at 8 or 10 lbs.

TABLE III. *Continued.*

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, &c.; the BREADTH being  $1\frac{1}{2}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	125·0	144·7	166·3	190·1	216·0	244·1	274·6	307·5	343·0	381·0
	DEPTH IN INCHES.									
1	·79	·83	·87	·91	·95	·98	1·02	1·06	1·10	1·14
2	1·58	1·65	1·73	1·81	1·89	1·97	2·05	2·13	2·21	2·28
3	2·36	2·48	2·60	2·72	2·84	2·95	3·07	3·19	3·31	3·43
4	3·15	3·31	3·47	3·62	3·78	3·94	4·10	4·25	4·41	4·57
5	3·94	4·14	4·33	4·53	4·73	4·92	5·12	5·32	5·52	5·71
6	4·73	4·96	5·20	5·44	5·67	5·91	6·15	6·38	6·62	6·85
7	5·52	5·79	6·07	6·34	6·62	6·89	7·17	7·45	7·72	8·00
8	6·30	6·62	6·93	7·25	7·56	7·88	8·19	8·51	8·82	9·14
*9	7·09	7·45	7·80	8·15	8·51	8·86	9·22	9·57	9·93	10·28
10	7·88	8·27	8·67	9·06	9·45	9·85	10·24	10·64	11·03	11·42
11	8·67	9·10	9·53	9·97	10·40	10·83	11·27	11·70	12·13	12·57
12	9·45	9·93	10·40	10·87	11·35	11·82	12·29	12·76	13·24	13·71
13	10·24	10·75	11·27	11·78	12·29	12·80	13·32	13·83	14·34	14·85
14	11·03	11·58	12·13	12·69	13·24	13·79	14·34	14·89	...	...
15	11·82	12·41	13·00	13·59	14·18	14·77	...	...	...	...
16	12·61	13·24	13·87	14·50	15·13	...	...	...	...	...
17	13·39	14·06	14·73	15·40	...	...	...	...	...	...
18	14·18	14·89	15·60	...	...	...	...	...	...	...
19	14·97	15·72	...	...	...	...	...	...	...	...
20	15·76	...	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

6·67	6·35	6·06	5·80	5·56	5·34	5·13	4·94	4·76	4·60
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\* \* The depth and weight being the same, the deflection varies inversely as the breadth; as in the example to this, and the following tables.

\* *Example.*—A Red Pine joist 9 feet long 7·09 in. by  $1\frac{1}{2}$  in., with 125 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{9}{40}$  of an inch; with the same weight, 7·09 in. by  $1\frac{3}{4}$  in. deflects  $\frac{9}{47}$  of an inch; 7·09 in. by 2 in. deflects  $\frac{9}{53}$  of an inch; 7·09 in. by  $2\frac{1}{4}$  in. deflects  $\frac{9}{60}$  of an inch; 7·09 in. by  $2\frac{1}{2}$  in. deflects  $\frac{9}{66}$  of an inch; 7·09 in. by  $2\frac{3}{4}$  in. deflects  $\frac{9}{73}$  of an inch; and 7·09 in. by 3 in. deflects  $\frac{9}{80}$  of an inch.

TABLE IV.

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, &c.; the BREADTH being  $1\frac{3}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	15·62	20·79	27·00	34·32	42·87	52·73	64·00	76·76	91·12	107·17
	DEPTH IN INCHES.									
1	·37	·41	·45	·49	·52	·56	·60	·64	·67	·71
2	·75	·82	·90	·97	1·05	1·12	1·20	1·27	1·35	1·42
3	1·12	1·23	1·35	1·46	1·57	1·68	1·80	1·91	2·02	2·13
4	1·50	1·65	1·80	1·95	2·10	2·25	2·39	2·54	2·69	2·84
5	1·87	2·06	2·25	2·43	2·62	2·81	2·99	3·18	3·37	3·55
*6	2·25	2·47	2·69	2·92	3·14	3·37	3·59	3·82	4·04	4·27
7	2·62	2·88	3·14	3·41	3·67	3·93	4·19	4·45	4·71	4·98
8	2·99	3·29	3·59	3·89	4·19	4·49	4·79	5·10	5·39	5·69
9	3·37	3·70	4·04	4·38	4·71	5·05	5·39	5·73	6·06	6·40
10	3·74	4·12	4·49	4·86	5·24	5·61	5·99	6·36	6·74	7·11
11	4·12	4·53	4·94	5·35	5·76	6·17	6·59	7·01	7·41	7·82
12	4·49	4·94	5·39	5·84	6·29	6·74	7·18	7·63	8·08	8·53
13	4·86	5·35	5·84	6·32	6·81	7·30	7·78	8·27	8·76	9·24
14	5·24	5·76	6·29	6·81	7·33	7·86	8·38	8·91	9·43	9·95
15	5·61	6·17	6·74	7·30	7·86	8·42	8·98	9·54	10·10	10·66
16	5·99	6·59	7·18	7·78	8·38	8·98	9·58	10·18	10·78	11·38
17	6·36	7·00	7·63	8·27	8·91	9·54	10·18	10·81	11·45	12·09
18	6·74	7·41	8·08	8·76	9·43	10·10	10·78	11·45	12·12	12·80
19	7·12	7·82	8·53	9·24	9·95	10·66	11·38	12·09	12·80	13·51
20	7·48	8·23	8·98	9·73	10·48	11·23	11·97	12·72	13·47	14·22

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

14·05	12·77	11·70	10·80	10·03	9·36	8·78	8·26	7·80	7·39
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\* \* The weight of Slatting, including the force of the wind, may be estimated at 56 lbs., and that of Tiling, at 62 lbs. per superficial foot.

\* *Example.*—If the Rafters for a slated roof be 15 inches apart from middle to middle, the pressure upon each foot in length is  $56 \times 1' 3'' = 70$  lbs. A Rafter 6 feet long, 3·82 in. by  $1\frac{1}{2}$  in., with 76·76 lbs. weight to the foot, deflects in the middle  $\frac{6}{40}$  of an inch; and the breaking weight of the same is  $6 \times 76·76 \times 8·26 = 3804$  lbs., the pressure being uniform, and at right angles to the plane of the roof.



TABLE IV. *Continued.*

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, &c.; the BREADTH being  $1\frac{3}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	125·0	144·7	166·3	190·1	216·0	244·1	274·6	307·5	343·0	381·0
	DEPTH IN INCHES.									
1	·75	·79	·82	·86	·90	·94	·97	1·01	1·05	1·09
2	1·50	1·57	1·65	1·72	1·80	1·87	1·95	2·02	2·10	2·17
3	2·25	2·36	2·47	2·58	2·69	2·81	2·92	3·03	3·14	3·26
4	2·99	3·14	3·29	3·44	3·59	3·74	3·89	4·04	4·19	4·34
5	3·74	3·93	4·12	4·30	4·49	4·68	4·86	5·05	5·24	5·43
6	4·49	4·71	4·94	5·16	5·39	5·61	5·84	6·06	6·29	6·51
7	5·24	5·50	5·76	6·02	6·29	6·55	6·81	7·07	7·33	7·60
8	5·99	6·29	6·59	6·89	7·18	7·48	7·78	8·08	8·38	8·68
*9	6·74	7·07	7·41	7·75	8·08	8·42	8·76	9·09	9·43	9·77
10	7·48	7·86	8·23	8·61	8·98	9·36	9·73	10·10	10·48	10·85
11	8·23	8·64	9·06	9·47	9·88	10·29	10·70	11·11	11·53	11·94
12	8·98	9·43	9·88	10·33	10·78	11·23	11·68	12·12	12·57	13·02
13	9·73	10·22	10·70	11·19	11·68	12·16	12·65	13·13	13·62	14·11
14	10·48	11·00	11·53	12·05	12·57	13·10	13·62	14·14	14·67	15·19
15	11·23	11·79	12·35	12·91	13·47	14·03	14·59	15·16	15·72	...
16	11·97	12·57	13·17	13·77	14·37	14·97	15·57	...	...	...
17	12·72	13·36	14·00	14·63	15·27	15·90	...	...	...	...
18	13·47	14·14	14·82	15·49	...	...	...	...	...	...
19	14·22	14·93	15·64	...	...	...	...	...	...	...
20	14·97	15·72	...	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·02	6·69	6·38	6·10	5·85	5·62	5·40	5·20	5·01	4·84
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\* *Example.*—A Red Pine Scantling 9 feet long 7·07 in. by  $1\frac{3}{4}$  in., with 144·7 lbs. weight to the foot, uniformly loaded, defects in the middle  $\frac{9}{40}$  of an inch; with the same weight, 7·07 in. by 2 in. defects  $\frac{9}{40}$  of an inch; 7·07 in. by  $2\frac{1}{4}$  in. defects  $\frac{9}{31}$  of an inch; 7·07 in. by  $2\frac{1}{2}$  in. defects  $\frac{9}{27}$  of an inch; 7·07 in. by  $2\frac{3}{4}$  in. defects  $\frac{9}{25}$  of an inch; and 7·07 in. by 3 in. defects  $\frac{9}{18}$  of an inch.

The breaking weight of Red Pine 9 feet long 7·07 in. by  $1\frac{3}{4}$  in., is  $9 \times 144·7 \times 6·69 = 8712$  lbs. uniformly loaded, or 4356 lbs. suspended from the middle.

TABLE V.

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being 2 INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	15·62	20·79	27·00	34·32	42·87	52·73	64·00	76·76	91·12	107·17
	DEPTH IN INCHES.									
1	·36	·39	·43	·47	·50	·54	·57	·61	·64	·68
2	·72	·79	·86	·93	1·00	1·07	1·15	1·22	1·29	1·36
3	1·07	1·18	1·29	1·40	1·50	1·61	1·72	1·83	1·93	2·04
4	1·43	1·57	1·72	1·86	2·00	2·15	2·29	2·43	2·58	2·72
5	1·79	1·97	2·15	2·33	2·51	2·68	2·86	3·04	3·22	3·40
6	2·15	2·36	2·58	2·79	3·01	3·22	3·44	3·65	3·87	4·08
7	2·51	2·76	3·01	3·26	3·51	3·76	4·01	4·26	4·51	4·76
8	2·86	3·15	3·44	3·72	4·01	4·30	4·58	4·87	5·15	5·44
9	3·22	3·54	3·87	4·19	4·51	4·83	5·15	5·48	5·80	6·12
10	3·58	3·94	4·30	4·65	5·01	5·37	5·73	6·08	6·44	6·80
11	3·94	4·33	4·72	5·12	5·51	5·91	6·30	6·69	7·09	7·48
12	4·30	4·72	5·15	5·58	6·01	6·44	6·87	7·30	7·73	8·16
13	4·65	5·12	5·58	6·05	6·51	6·98	7·44	7·91	8·38	8·84
14	5·01	5·51	6·01	6·51	7·01	7·52	8·02	8·52	9·02	9·52
15	5·37	5·91	6·44	6·98	7·52	8·05	8·59	9·13	9·66	10·20
16	5·73	6·30	6·87	7·44	8·02	8·59	9·16	9·74	10·31	10·88
17	6·08	6·69	7·30	7·91	8·52	9·13	9·74	10·34	10·95	11·56
18	6·44	7·09	7·73	8·38	9·02	9·67	10·31	10·95	11·60	12·24
19	6·80	7·48	8·16	8·84	9·52	10·20	10·88	11·56	12·24	12·92
20	7·16	7·87	8·59	9·31	10·02	10·74	11·45	12·17	12·89	13·60

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

14·69	13·35	12·24	11·30	10·49	9·79	9·18	8·64	8·16	7·73
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\*\* The greatest weight upon the floor of a crowded room is 120 lbs. per superficial foot, to which, in determining the scantlings, is to be added the weight of the floor and ceiling. The greatest weight will generally vary from about 140 lbs. to 160 lbs. per foot superficial, and the *breaking weight* of every floor liable to be so weighted, should be *not less than 4 times that weight*, viz. 5 cwt. to the foot, or upwards.

Joists of small scantlings, in short lengths, should be increased in the depth or breadth, or in both, according to the liability to decay, from the situation in which they may be placed.

TABLE V. *Continued.*

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being 2 INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	125·0	144·7	166·3	190·1	216·0	244·1	274·6	307·5	343·0	381·0
	DEPTH IN INCHES.									
1	·72	·75	·79	·82	·86	·89	·93	·97	1·00	1·04
2	1·43	1·50	1·57	1·65	1·72	1·79	1·86	1·93	2·00	2·08
3	2·15	2·25	2·36	2·47	2·58	2·68	2·79	2·90	3·01	3·11
4	2·86	3·01	3·15	3·29	3·44	3·58	3·72	3·87	4·01	4·15
5	3·58	3·76	3·94	4·12	4·30	4·47	4·65	4·83	5·01	5·19
6	4·30	4·51	4·72	4·94	5·15	5·37	5·58	5·80	6·01	6·23
7	5·01	5·26	5·51	5·76	6·01	6·26	6·51	6·76	7·02	7·27
8	5·73	6·01	6·30	6·59	6·87	7·16	7·44	7·73	8·02	8·30
9	6·44	6·76	7·09	7·41	7·73	8·05	8·38	8·70	9·02	9·34
10	7·16	7·52	7·87	8·23	8·59	8·95	9·31	9·66	10·02	10·38
11	7·87	8·27	8·66	9·06	9·45	9·84	10·24	10·63	11·02	11·42
12	8·59	9·02	9·45	9·88	10·31	10·74	11·17	11·60	12·03	12·46
13	9·31	9·77	10·24	10·70	11·17	11·63	12·10	12·56	13·03	13·49
* 14	10·02	10·52	11·02	11·53	12·03	12·53	13·03	13·53	14·03	14·53
15	10·74	11·27	11·81	12·35	12·89	13·42	13·96	14·50	15·03	15·57
16	11·45	12·03	12·60	13·17	13·74	14·32	14·89	15·46	...	...
17	12·17	12·78	13·39	13·99	14·60	15·21	15·82	...	...	...
18	12·89	13·53	14·17	14·82	15·46	...	...	...	...	...
19	13·60	14·28	14·96	15·64	...	...	...	...	...	...
20	14·32	15·03	15·75	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·34	6·99	6·67	6·38	6·12	5·87	5·65	5·44	5·24	5·06
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\* *Example.*—The greatest weight upon a floor being 140 lbs. per superficial foot; if the joists be 14 inches apart, from middle to middle, the weight upon one foot in length of a joist is  $140 \times 1' \cdot 2'' = 163 \cdot 3$  lbs. A joist 14 feet long 11·02 in. by 2 in., with 166·3 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{1}{40}$  of an inch; with the same weight, 11·02 in. by  $2\frac{1}{4}$  in. deflects  $\frac{1}{40}$  of an inch; 11·02 in. by  $2\frac{1}{2}$  in. deflects  $\frac{1}{50}$  of an inch; 11·02 in. by  $2\frac{3}{4}$  in. deflects  $\frac{1}{50}$  of an inch; and 11·02 in. by 3 in. deflects  $\frac{1}{60}$  of an inch.

The breaking weight of a Red Pine joist 14 feet long 11·02 in. by 2 in., is 6·67 times the weight upon the floor, and the depth being the same, the strength increases as the breadth.

TABLE VI.

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{1}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	20·79	27·00	34·32	42·87	52·73	64·00	76·76	91·12	107·1	125·0
	DEPTH IN INCHES.									
1	·38	·41	·45	·48	·52	·55	·59	·62	·65	·69
2	·76	·83	·89	·96	1·03	1·10	1·17	1·24	1·31	1·38
3	1·14	1·24	1·34	1·45	1·55	1·65	1·76	1·86	1·96	2·07
4	1·51	1·65	1·79	1·93	2·07	2·20	2·34	2·48	2·62	2·75
5	1·89	2·07	2·24	2·41	2·58	2·75	2·93	3·10	3·27	3·44
6	2·27	2·48	2·68	2·89	3·10	3·30	3·51	3·72	3·92	4·13
7	2·65	2·89	3·13	3·37	3·61	3·86	4·10	4·34	4·58	4·82
8	3·03	3·30	3·58	3·86	4·13	4·41	4·68	4·96	5·23	5·51
9	3·41	3·72	4·03	4·34	4·65	4·96	5·27	5·58	5·89	6·20
10	3·79	4·13	4·47	4·82	5·16	5·51	5·85	6·20	6·54	6·88
11	4·16	4·54	4·92	5·30	5·68	6·06	6·44	6·82	7·19	7·57
12	4·54	4·96	5·37	5·78	6·20	6·61	7·02	7·43	7·85	8·26
13	4·92	5·37	5·82	6·26	6·71	7·16	7·61	8·05	8·50	8·95
14	5·30	5·78	6·26	6·75	7·23	7·71	8·19	8·67	9·16	9·64
15	5·68	6·20	6·71	7·23	7·74	8·26	8·78	9·29	9·81	10·33
16	6·06	6·61	7·16	7·71	8·26	8·81	9·36	9·91	10·46	11·01
17	6·44	7·02	7·61	8·19	8·78	9·36	9·95	10·53	11·12	11·70
18	6·82	7·43	8·05	8·67	9·29	9·91	10·53	11·15	11·77	12·39
19	7·19	7·85	8·50	9·16	9·81	10·46	11·12	11·77	12·43	13·08
20	7·57	8·26	8·95	9·64	10·33	11·01	11·70	12·39	13·08	13·77

Multipliers to give the *breaking weight* of every Scantling in each Column respectively.

13·89	12·73	11·75	10·91	10·19	9·55	8·99	8·49	8·04	7·64
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\* \* The weight of one cubic foot of water being 62·5 lbs., the pressure upon a floor, from a cistern 4 feet deep, lined with lead, and filled with water, may be estimated, without the weight of a ceiling, at 260 lbs. per foot superficial. If the joists to carry the same be 14 inches apart from middle to middle, the weight upon one foot in length of each joist, is  $260 \times 1'112'' = 303$  lbs.; and the scantlings for various deflections may be found by these tables, as in the next example.



TABLE VI. *Continued.*

By which may be determined the DEPTHS of Ceiling Joists, Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{1}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	144·7	166·3	190·1	216·0	244·1	274·6	307·5	343·0	381·0	421·8
	DEPTH IN INCHES.									
1	·72	·76	·79	·83	·86	·89	·93	·96	1·00	1·03
2	1·45	1·51	1·58	1·65	1·72	1·79	1·86	1·93	2·00	2·07
3	2·17	2·27	2·37	2·48	2·58	2·68	2·79	2·89	2·99	3·10
4	2·89	3·03	3·17	3·30	3·44	3·58	3·72	3·86	3·99	4·13
5	3·61	3·79	3·96	4·13	4·30	4·47	4·65	4·82	4·99	5·16
*6	4·34	4·54	4·75	4·96	5·16	5·37	5·58	5·78	5·99	6·20
7	5·06	5·30	5·54	5·78	6·02	6·26	6·51	6·75	6·99	7·23
8	5·78	6·06	6·33	6·61	6·88	7·16	7·43	7·71	7·99	8·26
9	6·51	6·82	7·13	7·43	7·74	8·05	8·36	8·67	8·98	9·29
10	7·23	7·57	7·92	8·26	8·61	8·95	9·29	9·64	9·98	10·33
11	7·95	8·33	8·71	9·09	9·47	9·84	10·22	10·60	10·98	11·36
12	8·67	9·09	9·50	9·91	10·33	10·74	11·15	11·57	11·98	12·39
13	9·40	9·84	10·29	10·74	11·19	11·63	12·08	12·53	12·98	13·42
14	10·12	10·60	11·08	11·57	12·05	12·53	13·01	13·49	13·97	14·46
15	10·84	11·36	11·88	12·39	12·91	13·42	13·94	14·46	14·97	15·49
16	11·57	12·12	12·67	13·22	13·77	14·32	14·87	15·42	15·97	...
17	12·29	12·87	13·46	14·04	14·63	15·21	15·80	...	...	...
18	13·01	13·63	14·25	14·87	15·49	...	...	...	...	...
19	13·73	14·39	15·04	15·70	...	...	...	...	...	...
20	14·46	15·14	15·83	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·27	6·94	6·64	6·36	6·11	5·87	5·66	5·45	5·27	5·09
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\* *Example.*—A joist 6 feet long 5·58 in by  $2\frac{1}{4}$  in., with 307·5 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{6}{40}$  of an inch; with the same weight, 5·58 in. by  $2\frac{1}{2}$  in., deflects  $\frac{6}{44}$  of an inch; 5·58 in. by  $2\frac{3}{4}$  in., deflects  $\frac{6}{49}$  of an inch; and 5·58 in. by 3 in. deflects  $\frac{6}{53}$  of an inch.

If the joists to carry the cistern (p. 138) be 16 inches apart from middle to middle, the weight upon one foot in length of each joist is  $260 \times 1'11\frac{1}{4}'' = 346\cdot6$  lbs. The scantlings are found by the next column, viz. 5·78 in. by  $2\frac{1}{4}$  in.; 5·78 in. by  $2\frac{1}{2}$  in.; &c. &c.

TABLE VII.

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{1}{2}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	27·00	34·32	42·87	52·73	64·00	76·76	91·12	107·1	125·0	144·7
DEPTH IN INCHES.										
1	·40	·43	·47	·50	·53	·56	·60	·63	·66	·70
2	·80	·86	·93	1·00	1·06	1·13	1·20	1·26	1·33	1·40
3	1·20	1·30	1·40	1·50	1·59	1·69	1·79	1·89	1·99	2·09
4	1·59	1·73	1·86	1·99	2·13	2·26	2·39	2·53	2·66	2·79
5	1·99	2·16	2·33	2·49	2·66	2·82	2·99	3·16	3·32	3·49
6	2·39	2·59	2·79	2·99	3·19	3·39	3·59	3·79	3·99	4·19
7	2·79	3·02	3·26	3·49	3·72	3·95	4·19	4·42	4·65	4·88
8	3·19	3·46	3·72	3·99	4·25	4·52	4·78	5·05	5·32	5·58
9	3·59	3·89	4·19	4·49	4·78	5·08	5·38	5·69	5·98	6·28
10	3·99	4·32	4·65	4·98	5·32	5·65	5·98	6·32	6·65	6·98
11	4·39	4·75	5·12	5·48	5·85	6·21	6·58	6·95	7·31	7·67
12	4·78	5·18	5·58	5·98	6·38	6·78	7·18	7·58	7·97	8·37
13	5·18	5·62	6·05	6·48	6·91	7·34	7·77	8·21	8·64	9·07
14	5·58	6·05	6·51	6·98	7·44	7·91	8·37	8·84	9·30	9·77
15	5·98	6·48	6·98	7·48	7·97	8·47	8·97	9·48	9·97	10·47
16	6·38	6·91	7·44	7·97	8·51	9·04	9·57	10·11	10·63	11·16
17	6·78	7·34	7·91	8·47	9·04	9·60	10·17	10·74	11·30	11·86
18	7·18	7·77	8·37	8·97	9·57	10·17	10·76	11·37	11·96	12·56
19	7·58	8·21	8·84	9·47	10·10	10·73	11·36	12·00	12·63	13·26
20	7·97	8·64	9·30	9·97	10·63	11·30	11·96	12·63	13·29	13·95

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

13·18	12·17	11·30	10·55	9·89	9·30	8·79	8·32	7·91	7·53
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\* \* If an imperial bushel of grain weigh 60 lbs., then ONE CUBIC FOOT of the same grain weighs 46·74 lbs., or 4173 cwt.

If the grain upon a warehouse floor be 5 feet in depth, the weight upon the floor, allowing 103 lbs. to the foot for the weight of the boards and joists, is 244 lbs., or 2·18 cwt. per superficial foot. If the joists be  $13\frac{1}{2}$  inches, and the beams 9 feet apart, from middle to middle, the weight upon one foot in length of each joist is  $244 \times 1' 11\frac{1}{2}'' = 274\frac{1}{2}$  lbs., and of each beam  $9 \times 2·18 = 19·62$  cwt., or say, including the weight of the beam, 20 cwt.

The scantlings to carry those weights may be found by the Miscellaneous Tables, as in the annexed Example.

TABLE VII. *Continued.*

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{1}{2}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	166·3	190·1	216·0	244·1	274·6	307·5	343·0	381·0	421·8	465·4
	DEPTH IN INCHES.									
1	·73	·76	·80	·83	·86	·90	·93	·96	1·00	1·03
2	1·46	1·53	1·59	1·66	1·73	1·79	1·86	1·93	1·99	2·06
3	2·19	2·29	2·39	2·49	2·59	2·69	2·79	2·89	2·99	3·09
4	2·92	3·06	3·19	3·32	3·46	3·59	3·72	3·85	3·99	4·12
5	3·65	3·82	3·99	4·15	4·32	4·49	4·65	4·82	4·98	5·15
6	4·39	4·59	4·78	4·98	5·18	5·38	5·58	5·78	5·98	6·18
7	5·12	5·35	5·58	5·81	6·05	6·28	6·51	6·74	6·98	7·21
*8	5·85	6·11	6·38	6·65	6·91	7·18	7·44	7·71	7·97	8·24
9	6·58	6·88	7·18	7·48	7·77	8·07	8·37	8·67	8·97	9·27
10	7·31	7·64	7·97	8·31	8·64	8·97	9·30	9·64	9·97	10·30
11	8·04	8·41	8·77	9·14	9·50	9·87	10·23	10·60	10·96	11·33
12	8·77	9·17	9·57	9·97	10·37	10·76	11·16	11·56	11·96	12·36
13	9·50	9·93	10·37	10·80	11·23	11·66	12·09	12·53	12·96	13·39
14	10·23	10·70	11·16	11·63	12·09	12·56	13·02	13·49	13·95	14·42
15	10·96	11·46	11·96	12·46	12·96	13·46	13·95	14·45	14·95	15·45
16	11·70	12·23	12·76	13·29	13·82	14·35	14·88	15·42	15·95	...
17	12·43	12·99	13·56	14·12	14·69	15·25	15·82	...	...	...
18	13·16	13·76	14·35	14·95	15·55	...	...	...	...	...
19	13·89	14·52	15·15	15·78	...	...	...	...	...	...
20	14·62	15·28	15·95	...	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·19	6·88	6·59	6·33	6·08	5·86	5·65	5·45	5·27	5·10
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\* *Example.*—A joist 8 feet long, 6·91 in. by  $2\frac{1}{2}$  in., with 274·6 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{8}{40}$  of an inch; with the same weight, 6·91 in. by  $2\frac{3}{4}$  in. deflects  $\frac{8}{44}$  of an inch; 6·91 in. by 3 in. deflects  $\frac{8}{48}$  of an inch; and the breaking weight of Red Pine 8 feet long, 6·91 in. by  $2\frac{1}{2}$  in., is 6·08 times the tabular weight.

By Table I., page 125, the breadth of a Red Pine beam, 14 inches deep and 16 feet long in the clear, which will *just break* with 20 cwts. to the foot, is  $20 \times 1633 = 3266$  inches; and if one-fourth of the breaking weight be the greatest weight with which a beam ought to be loaded, the breadth of the beam should be  $4 \times 3266 = 13064$  inches.

Therefore, upon the data in this and the preceding page, the scantlings are,—joists  $7 \times 2\frac{1}{2}$ ; beams  $14 \times 13$ , or if mortised for the joists, say  $14 \times 14$ . By Table II., page 129, the deflection of each beam is ·601, or  $\frac{3}{5}$  of an inch.

TABLE VIII.

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{3}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	34·32	42·87	52·73	64·00	76·76	91·12	107·1	125·0	144·7	166·3
	DEPTH IN INCHES.									
1	·42	·45	·48	·52	·55	·58	·61	·64	·68	·71
2	·84	·90	·97	1·03	1·09	1·16	1·22	1·29	1·35	1·42
3	1·26	1·35	1·45	1·55	1·64	1·74	1·83	1·93	2·03	2·12
4	1·67	1·80	1·93	2·06	2·19	2·32	2·45	2·58	2·70	2·83
5	2·09	2·25	2·41	2·58	2·74	2·90	3·06	3·22	3·38	3·54
6	2·51	2·70	2·90	3·09	3·28	3·48	3·67	3·86	4·06	4·25
*7	2·93	3·15	3·38	3·61	3·83	4·06	4·28	4·51	4·73	4·96
8	3·35	3·61	3·86	4·12	4·38	4·64	4·89	5·15	5·41	5·67
9	3·77	4·06	4·35	4·64	4·92	5·21	5·50	5·79	6·08	6·37
10	4·18	4·51	4·83	5·15	5·47	5·79	6·12	6·44	6·76	7·08
11	4·60	4·96	5·31	5·67	6·02	6·37	6·73	7·08	7·44	7·79
12	5·02	5·41	5·79	6·18	6·57	6·95	7·34	7·73	8·11	8·50
13	5·44	5·86	6·28	6·70	7·11	7·53	7·95	8·37	8·79	9·21
14	5·86	6·31	6·76	7·21	7·66	8·11	8·56	9·01	9·46	9·91
15	6·28	6·76	7·24	7·73	8·21	8·69	9·17	9·66	10·14	10·62
16	6·70	7·21	7·73	8·24	8·76	9·27	9·79	10·30	10·82	11·33
17	7·11	7·66	8·21	8·76	9·30	9·85	10·40	10·94	11·49	12·04
18	7·53	8·11	8·69	9·27	9·85	10·43	11·01	11·59	12·17	12·75
19	7·95	8·56	9·17	9·79	10·40	11·01	11·62	12·23	12·84	13·45
20	8·37	9·01	9·66	10·30	10·94	11·59	12·23	12·88	13·52	14·16

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

12·56	11·67	10·89	10·21	9·61	9·07	8·59	8·16	7·92	7·42
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\* *Example*.—If the weight upon each foot in length of a floor joist 7 feet long, 4·06 in. by  $2\frac{3}{4}$  in., be 91·12 lbs. to the foot, the deflection is  $\frac{7}{40}$  of an inch, and the breaking weight of the same is 9·07 times the tabular weight; if the weight upon each foot in length be  $91·12 \times 2 = 182·24$  lbs. to the foot, the deflection is  $\frac{7}{40} \times 2 = \frac{7}{20}$  of an inch, and the multiplier to give the breaking weight is  $\frac{9·07}{2} = 4·53$ .



TABLE VIII. *Continued.*

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being  $2\frac{3}{4}$  INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	190·1	216·0	244·1	274·6	307·5	343·0	381·0	421·8	465·4	512·0
	DEPTH IN INCHES.									
1	·74	·77	·80	·84	·87	·90	·93	·97	1·00	1·03
2	1·48	1·55	1·61	1·67	1·74	1·80	1·87	1·93	2·00	2·06
3	2·22	2·32	2·41	2·51	2·61	2·70	2·80	2·90	2·99	3·09
4	2·96	3·09	3·22	3·35	3·48	3·61	3·73	3·86	3·99	4·12
5	3·70	3·86	4·02	4·18	4·35	4·51	4·67	4·83	4·99	5·15
6	4·44	4·64	4·83	5·02	5·21	5·41	5·60	5·79	5·99	6·18
7	5·18	5·41	5·63	5·86	6·08	6·31	6·53	6·76	6·98	7·21
8	5·92	6·18	6·44	6·70	6·95	7·21	7·47	7·73	7·98	8·24
9	6·66	6·95	7·24	7·53	7·82	8·11	8·40	8·69	8·98	9·27
*10	7·40	7·73	8·05	8·37	8·69	9·01	9·33	9·66	9·98	10·30
11	8·14	8·50	8·85	9·21	9·56	9·91	10·27	10·62	10·98	11·33
12	8·88	9·27	9·66	10·04	10·43	10·82	11·20	11·59	11·97	12·36
13	9·62	10·04	10·46	10·88	11·30	11·72	12·14	12·55	12·97	13·39
14	10·36	10·82	11·27	11·72	12·17	12·62	13·07	13·52	13·97	14·42
15	11·11	11·59	12·07	12·55	13·04	13·52	14·00	14·48	14·97	15·45
16	11·85	12·36	12·88	13·39	13·91	14·42	14·94	15·45	15·97	16·48
17	12·59	13·13	13·68	14·23	14·77	15·32	15·87	16·42	16·97	...
18	13·33	13·91	14·48	15·06	15·64	16·22	16·80	...	...	...
19	14·07	14·68	15·29	15·90	16·51	...	...	...	...	...
20	14·81	15·45	16·09	16·74	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·10	6·80	6·53	6·28	6·05	5·83	5·63	5·44	5·27	5·10
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\* *Example.*—The greatest weight upon a joist for a warehouse floor being 465·4 lbs. to the foot, a Red Pine joist 10 feet long, 9·98 in. by  $2\frac{3}{4}$  in., uniformly loaded with that weight, deflects in the middle  $\frac{1}{40}$  or  $\frac{1}{4}$  of an inch; with the same weight, 9·98 in. by 3 in. deflects  $\frac{1}{40}$  of an inch.

The breaking weight of a Red Pine joist 10 feet long 9·98 in. by  $2\frac{3}{4}$  in., is 5·27 times the tabular weight.

TABLE IX.

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being 3 INCHES, and the deflection  $\frac{1}{8}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	42·87	52·73	64·00	76·76	91·12	107·1	125·0	144·7	166·3	190·1
	DEPTH IN INCHES.									
1	·44	·47	·50	·53	·56	·59	·63	·66	·69	·72
2	·88	·94	1·00	1·06	1·13	1·19	1·25	1·31	1·38	1·44
3	1·31	1·41	1·50	1·59	1·69	1·78	1·88	1·97	2·06	2·16
4	1·75	1·88	2·00	2·13	2·25	2·38	2·50	2·63	2·75	2·88
5	2·19	2·35	2·50	2·66	2·81	2·97	3·13	3·28	3·44	3·60
6	2·63	2·81	3·00	3·19	3·38	3·56	3·75	3·94	4·13	4·31
7	3·06	3·28	3·50	3·72	3·94	4·16	4·38	4·60	4·82	5·03
8	3·50	3·75	4·00	4·25	4·50	4·75	5·00	5·25	5·50	5·75
9	3·94	4·22	4·50	4·78	5·07	5·35	5·63	5·91	6·19	6·47
10	4·38	4·69	5·00	5·32	5·63	5·94	6·25	6·57	6·88	7·19
11	4·82	5·16	5·50	5·85	6·19	6·53	6·88	7·22	7·57	7·91
12	5·25	5·63	6·00	6·38	6·75	7·13	7·50	7·88	8·25	8·63
13	5·69	6·10	6·50	6·91	7·32	7·72	8·13	8·54	8·94	9·35
14	6·13	6·57	7·00	7·44	7·88	8·32	8·75	9·19	9·63	10·07
15	6·57	7·04	7·50	7·97	8·44	8·91	9·38	9·85	10·32	10·79
*16	7·00	7·50	8·00	8·50	9·00	9·51	10·01	10·51	11·01	11·51
17	7·44	7·97	8·50	9·04	9·57	10·10	10·63	11·16	11·69	12·23
18	7·88	8·44	9·01	9·57	10·13	10·69	11·26	11·82	12·38	12·94
19	8·32	8·91	9·51	10·10	10·69	11·29	11·88	12·48	13·07	13·66
20	8·75	9·38	10·01	10·63	11·26	11·88	12·51	13·13	13·76	14·38
Multipliers to give the <i>breaking weight</i> of every Scantling in each column respectively.										
	12·01	11·21	10·51	9·89	9·34	8·85	8·40	8·00	7·64	7·31

\* *Example*.—A joist 16 feet long, 11·01 in. by 3 in., with 166·3 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{1}{8}$  or  $\frac{2}{3}$  of an inch.

The breaking weight of a Red Pine joist 16 feet long, 11·01 in. by 3 in., is  $16 \times 166·3 \times 7·61 = 20328$  lbs. = 181·5 cwt. uniformly loaded, or 90·7 cwt. suspended from the middle.

TABLE IX. *Continued.*

By which may be determined the DEPTHS of Rafters, Floor Joists, Bridging Joists, Binding Joists, &c.; the BREADTH being 3 INCHES, and the deflection  $\frac{1}{40}$  of an inch to the foot, when uniformly loaded with the weights in this table.

Length in feet, clear bearing.	WEIGHT IN POUNDS UPON EACH FOOT IN LENGTH.									
	216·0	244·1	274·6	307·5	343·0	381·0	421·8	465·4	512·0	561·5
	DEPTH IN INCHES.									
1	·75	·78	·81	·84	·88	·91	·94	·97	1·00	1·03
2	1·50	1·56	1·63	1·69	1·75	1·81	1·88	1·94	2·00	2·06
3	2·25	2·35	2·44	2·53	2·63	2·72	2·81	2·91	3·00	3·10
4	3·00	3·13	3·25	3·38	3·50	3·63	3·75	3·88	4·00	4·13
5	3·75	3·91	4·06	4·22	4·38	4·53	4·69	4·85	5·00	5·16
6	4·50	4·69	4·88	5·07	5·25	5·44	5·63	5·82	6·00	6·19
7	5·25	5·47	5·69	5·91	6·13	6·35	6·57	6·79	7·00	7·22
8	6·00	6·25	6·50	6·75	7·00	7·25	7·50	7·75	8·00	8·25
9	6·75	7·04	7·32	7·60	7·88	8·16	8·44	8·72	9·00	9·29
10	7·50	7·82	8·13	8·44	8·75	9·07	9·38	9·69	10·01	10·32
*11	8·25	8·60	8·94	9·29	9·63	9·97	10·32	10·66	11·01	11·35
12	9·01	9·38	9·76	10·13	10·51	10·88	11·26	11·63	12·01	12·38
13	9·76	10·16	10·57	10·97	11·38	11·79	12·19	12·60	13·01	13·41
14	10·51	10·94	11·38	11·82	12·26	12·69	13·13	13·57	14·01	14·45
15	11·26	11·73	12·19	12·66	13·13	13·60	14·07	14·54	15·01	15·48
16	12·01	12·51	13·01	13·51	14·01	14·51	15·01	15·51	16·01	16·51
17	12·76	13·29	13·82	14·35	14·88	15·41	15·95	16·48	...	...
18	13·51	14·07	14·63	15·20	15·76	16·32	16·88	...	...	...
19	14·26	14·85	15·45	16·04	16·63	...	...	...	...	...
20	15·01	15·63	16·26	16·88	...	...	...	...	...	...

Multipliers to give the *breaking weight* of every Scantling in each column respectively.

7·00	6·72	6·46	6·22	6·00	5·79	5·60	5·42	5·25	5·09
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\* *Example.*—A Red Pine joist 11 feet long, 11·01 in. by 3 in., with 512 lbs. weight to the foot, uniformly loaded, deflects in the middle  $\frac{1}{40}$  of an inch; and 5·25 times that weight is the breaking weight of the same.

\*\* When the breadth exceeds 3 inches, or the weight exceeds 561·5 lbs. to the foot, the Scantlings may be found by the FIRST SERIES OF TABLES, of which this and the six preceding tables form, by interpolation, a part.

TABLE X.

Shewing the Strength and Elasticity of various species of Timber,  
according to the Experiments made at Woolwich Dock Yard, by  
PETER BARLOW, Esq., F.R.S., &c.

No. of Experiments.	Name of the Wood.	Values of S from the formula $S = \frac{IW}{4ad^2}$			Relative Values of S, the mean value of S for each species of timber being 1·000.		
		Minimum Value of S.	Mean Value of S.	Maximum Value of S.	Minimum Value of S.	Mean Value of S.	Maximum Value of S.
3	Teak .....	2152·5	2463·1	2677·5	·873	1·000	1·087
3	Poon.....	2178·7	2220·7	2257·5	·981	1·000	1·016
6	Oak, English .....	1105·1	1427·5	1703·6	·774	1·000	1·193
3	„ Canadian ...	1708·8	1766·6	1858·5	·967	1·000	1·052
3	„ Dantzic .....	1365·0	1470·0	1522·5	·928	1·000	1·035
3	„ Adriatic .....	1312·5	1382·5	1470·0	·949	1·000	1·063
3	Ash .....	1995·0	2027·3	2047·5	·984	1·000	1·010
3	Beech .....	1483·1	1557·5	1614·3	·952	1·000	1·036
3	Elm .....	966·0	1015·0	1044·7	·951	1·000	1·029
3	Pine, Pitch .....	1561·8	1631·8	1706·2	·957	1·000	1·045
3	„ Red .....	1241·6	1341·3	1391·2	·925	1·000	1·037
3	Fir, New England	1057·8	1102·5	1170·7	·959	1·000	1·061
6	„ Riga .....	825·7	1079·2	1275·7	·765	1·000	1·182
10	„ Mar Forest ...	945·0	1215·6	1350·0	·777	1·000	1·110
13	Larch .....	675·0	1000·6	1242·0	·674	1·000	1·241
3	Norway Spar .....	1388·2	1473·0	1530·0	·942	1·000	1·038
71	Mean results .....	.....	.....	.....	·897	1·000	1·077

\* \* By this table may be compared the least, mean, and greatest strength of the several species of timber, thus:—

weakest English Oak : strongest Elm :: 1105·1 : 1044·7

The mean strength of Dantzic Oak is the same as the greatest strength of Adriatic Oak, so that the scantlings of the former are those of the latter.

By means of the relative values of S may be found, if requisite, the scantlings for the weakest or strongest of the various species of timber.



TABLE X. *Continued.*

Shewing the Strength and Elasticity of various species of Timber,  
according to the Experiments made at Woolwich Dock Yard, by  
PETER BARLOW, Esq., F.R.S., &c.

No. of Experiments.	Name of the Wood.	Value of E from the formula $E = \frac{3W}{32ad^3}$	Greatest weight while the Elasticity remains perfect, the breaking weight being 1·0000*	Reciprocal of the same.	Specific gravity.	Weight of one Cubic Foot.	
						In lbs.	In cwt.
3	Teak .....	301730	·3197	3·127	745	46·56	·4157
3	Poon .....	211160	·1773	5·640	579	36·18	·3231
6	Oak, English .....	145040	·3231	3·094	952	59·50	·5312
3	„ Canadian .....	241920	·3343	2·991	872	54·50	·4866
3	„ Dantzic .....	145770	·3571	2·800	756	47·25	·4218
3	„ Adriatic .....	121430	·2848	3·511	993	62·06	·5541
3	Ash .....	205630	·2913	3·432	760	47·50	·4241
3	Beech .....	169190	·2528	3·955	676	42·25	·3772
3	Elm .....	85880	·3232	3·093	553	34·56	·3086
3	Pine, Pitch .....	153080	·2412	4·144	660	41·25	·3683
3	„ Red .....	230000	·2935	3·406	657	41·06	·3666
3	Fir, New England	186580	·3571	2·800	553	34·56	·3086
6	„ Riga .....	143450	·3082	3·244	745	46·56	·4157
10	„ Mar Forest .....	105190	·2746	3·640	697	43·56	·3889
13	Larch .....	114450	·3230	3·095	544	34·00	·3035
3	Norway Spar .....	182250	·3055	3·273	593	37·06	·3309
71							

\* When the weight is uniformly loaded, multiply the greatest weights &c. in col. 4 by ·8; and the reciprocals of the same in col. 5 by 1·25.

\*\* 28 of the above experiments were made upon scantlings 2 inches square and 6 feet long, and 43 upon scantlings 2 inches square and 7 feet long, clear of the supports; the weights in each experiment being suspended from the middle.

This Table is constructed from the *Experiments*, in the Table of Data, published in *Barlow's Treatise on the Strength of Materials*, 1845 edition, page 148.

TABLE XI.

Shewing the mean Strength and Elasticity of various species of Timber according to the additional Experiments made by P. W. BARLOW Esq., C.E.

No. of Experiments.	Name of the Wood.	Value of S from the formula $S = \frac{W}{4ad^2}$ .	Value of E from the formula $E = \frac{32ad^3\delta}{W}$ .	Specific gravity.	Weight of One Cubic Foot.	
					In lbs.	In cwt.
1	Acacia .....	1867	144000	710	44·37	·3962
4	Oak .....	1413	125900	891	55·68	·4972
2	„ superior quality...	2149	192300	752	47·00	·4196
2	Tonquin Bean .....	3626	332000	1058	66·12	·5904
2	Locust .....	3437	243200	954	59·62	·5323
2	Bullet Tree .....	2650	328600	1029	64·31	·5742
2	Greenheart .....	2737	332000	1000	62·50	·5580
2	Cabacally .....	2518	230900	900	56·25	·5022
4	African Oak, superior quality .....	2496	288100	983	61·43	·5485
4	American Black Birch .....	1818	184600	649	40·56	·3621
2	Common Birch .....	1928	205600	711	44·43	·3967
2	Ash .....	2037	161100	714	44·62	·3984
2	Elm .....	1118	92750	543	33·93	·3030
2	Christiana Deal .....	1556	198700	689	43·06	·3844
2	Memel Deal .....	1731	205400	590	36·87	·3292
35						

\* \* \* The above experiments were made upon scantlings 2 inches square and 50 inches length, clear of the supports.—For the original table and experiments, see *Barlow's Treatise on the Strength of Materials*, page 153.

The Tables of Constants, in the former part of this work, are founded upon the mean values of S and E, for the various woods specified in this and the preceding table; the value of S and E, for Oak, Ash, and Elm, being those given in Table X.

ON THE  
ADMEASUREMENT  
OF  
EARTHWORK IN RAILWAY CUTTINGS  
AND EMBANKMENTS.

# ON THE ADMEASUREMENT OF EARTHWORK IN RAILWAY CUTTINGS AND EMBANKMENTS.

Let *Fig. 1* represent the plan of a railroad and cuttings; *Fig. 2*, the cross section through EH; and *Fig 3*, the longitudinal section through the middle of the roadway, parallel to BK or CL.

FIG 1



FIG 2

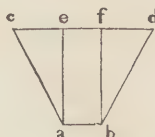
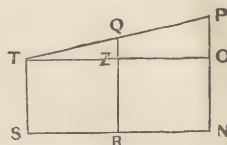


FIG 3



In *Fig. 1*, let BK be parallel to CL and at right angles to AD and IM; let AB=CD; and IK=LM; bisect CL in F, through F draw EFGH intersecting DM, BK, AI, in E, G, H. In *Fig. 2*, let *cd* be parallel to *ab*; and *ae*, *bf* perpendicular to *ab*, *cd*; *ce*=*fd*. In *Fig 3*, let ST, NP, be vertical to SN; from T draw TO parallel to SN; bisect SN in R; and from R draw RZQ parallel to ST, NP; intersecting TO, TP in Z, Q.

Let SN=L; *n*. RQ=GH=FE; then the true content of the whole solid ABCDMLKIA =V, may be found by any of the following equations,\* viz. :—

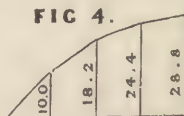
$$V = \left\{ n.RQ^2 + RQ \times FG + \frac{n.ZQ^2}{3} \right\} \times L \dots\dots\dots (1)$$

$$V = \left\{ \frac{EH^2 - FG^2}{4n} + \frac{n.ZQ^2}{3} \right\} \times L \dots\dots\dots (2)$$

$$V = \left\{ \frac{EG \times GH}{n} + \frac{n.ZQ^2}{3} \right\} \times L \dots\dots\dots (3)$$

## Example to the first equation.

Let the vertical ordinates in feet, be as in *Fig. 4* and 1 chain apart; *n*=1.5; width of Roadway FG=40 feet, then the true content of the whole figure by equation (1), is as follows:—



RQ <sup>2</sup>	Middle ordinate. RQ.	Ordinate ST or NP.	Difference ZQ.	ZQ <sup>2</sup> .
25.00	5.0	00.0	5.0	25.00
198.81	14.1	10.0	4.1	16.81
453.69	21.3	18.2	3.1	9.61
707.56	26.6	28.8	2.2	4.84
1385.06	67.0			56.26

$$1385.06 \times 1.5 = 2077.59 = RQ^2 \times n$$

$$67.00 \times 40.0 = 2680.00 = RQ \times FG$$

$$56.26 \times .5 = 28.13 = ZQ^2 \times \frac{n}{3}$$

$$4785.72 \times 66 = 315857.52 \text{ Cubic feet the true content.}$$

In the same Example, if *n*=2, } 5487.62 × 66 = 362182.92 Cubic feet.  
then the true content is

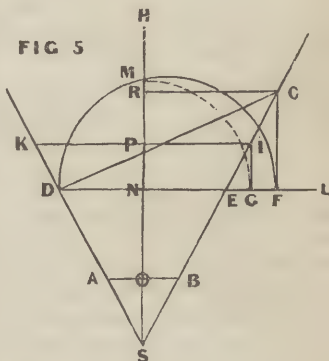
\* See Note, page 152.



From the values of the middle ordinate RQ in col. 2,  $n=1.5$ , and  $FG=40$ ; the middle widths EH in *Fig. 1* are, 55.0; 82.3; 103.9; 119.8; respectively; which being substituted in (2) and (3), the same result is obtained as by equation (1.)

If the values of ZQ be small or nearly equal, so that by a few trials a mean value of  $ZQ^2$  may be found sufficiently near the true average value, then, the slope  $n$  to 1, the width of the road FG and the length L being measured off or given, the only dimension requisite to be taken, in equation (1), is the middle ordinate RQ, and in (2) and (3), the middle width EH; the squares of which in (1) and (2), may be written down from a table of squares, as in the preceding example.

If the railway pass through the side of a hill, then in *Fig. 5*, let DABC represent a vertical middle section through EH in *Fig. 1*. Let the angle  $DAB = \text{angle } CBA$ , and let DA and CB produced, meet in S; draw DL parallel to AB, cutting BC in E; also draw SH perpendicular to AB, DE, bisecting the same in O and N; let  $n \cdot SN = ND = NE$ ; demit CF perpendicular to DL, intersecting DL in F; upon DF as a diameter describe the semicircle DMF, cutting SH in M; make  $NG = NM$ ; from G draw GI at right angles to DL, intersecting BC in I; from I draw IK parallel to LD, intersecting SD produced in K, and cutting SH in P; then the



area of the quadrilateral KDEIK = area of the triangle DEC.

From C, draw CR parallel to LD, intersecting SH in R, then

$$OP = \frac{\sqrt{RC \times NE - OB^2}}{n} = \frac{NM - AO}{n}$$

and the true content =  $V'$ , of the solid, of which the middle section is DABC and the length L, may be found by either of the following equations, viz.:—

$$V' = \left\{ \frac{RC \times NE - OB^2}{n} + \frac{n \cdot ZQ^2}{3} \right\} \times L \dots \dots \dots (4)$$

$$V' = \left\{ n \cdot ON \times OR + (ON + OR) OB + \frac{n \cdot ZQ^2}{3} \right\} \times L \dots \dots \dots (5)$$

in which ZQ, as before, is one-half the difference of the two end ordinates NP, ST in *Fig. 3*; ON, OR, in (5) and *Fig. 5*, being perpendiculars let fall from the points D and C, upon AB produced both ways. Moreover, RQ in *Fig. 3*, = OP in *Fig. 5*, is the common intersection of the two planes SNPT, KAB, *Figs. 3* and *5*; also the end sections of the solid are each parallel to the plane DABC; and the length L is limited by the distance between the points in which D coincides with the extreme width of the road as at A, near each end of the cutting.

*Example.*—Let  $RC=74$ ;  $NE=56$ ;  $OB=20$ ;  $ZQ$  (*Fig. 3*) = 6;  $n=1.5$ ; then  $ON = \frac{NE-OB}{n} = \frac{56-20}{1.5} = 24$ ;  $OR = \frac{RC-OB}{n} = \frac{74-20}{1.5} = 36$ ; and we have

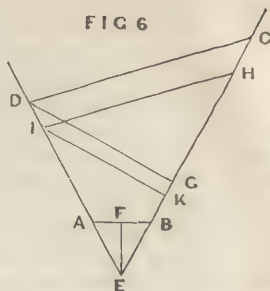
$$\text{From (4)} \quad V' = \left\{ \frac{74 \times 56 - 20 \times 20}{1.5} + \frac{1.5 \times 36}{3} \right\} \times L = 2514 \times L.$$

$$\text{From (5)} \quad V' = \left\{ 1.5 \times 24 \times 36 + 60 \times 20 + \frac{1.5 \times 36}{3} \right\} \times L = 2514 \times L.$$

the true content of the whole solid in either case.

The true content of the frustrum of the pyramid, and that of the ungula, may be found otherwise, thus:—

Let ABCD and ABHI represent the end cross sections through the cutting. Let the angle DAB=angle CBA. Demit DG, IK, perpendiculars upon EC, EH, respectively; produce CB, DA, to intersect in E; and draw EF perpendicular to AB, bisecting AB in F. Let the perpendicular distance between the parallel planes DABC, IABH=L; and  $V''$ =volume of the whole frustrum of the pyramid limited by the same planes, viz. DEC, IEH; then



$$V'' = \left( EC + EH + \frac{EH^2}{EC} \right) \times \frac{DG}{6} \times L \dots \dots \dots (6)$$

$$V'' = \left( EC + EH + \frac{EC^2}{EH} \right) \times \frac{IK}{6} \times L \dots \dots \dots (7)$$

The angle DAB=angle CBA being the same, as also the width of the road AB, the area of the triangular prism ABE is the same throughout the whole length of the cutting, and may therefore be deducted at one dimension; namely, for the distance between the points in which D and I coincide with the extremity of the road, as at A: moreover BE is constant, therefore by setting off BE from zero on the scale, or by adding the same, the dimensions may be taken without intersecting CB, DA, in E.

$$\text{If } AB=W; \text{ then } FE = \frac{W}{2n}; \text{ BE} = \frac{W}{2n} \sqrt{n^2 + 1}$$

*Example.*—Let the dimensions in feet be as follow, viz.:

$$EC=100; EH=80; \frac{EH^2}{EC} = \frac{80 \times 80}{100} = 64; DG=60; \frac{EC^2}{EH} = \frac{100 \times 100}{80} = 125; IK=48;$$

then we have

$$\text{From (6) } V'' = (100 + 80 + 64) \times \frac{60}{6} \times L = 2440 \times L.$$

$$\text{From (7) } V'' = (100 + 80 + 125) \times \frac{48}{6} \times L = 2440 \times L.$$

the same in both cases, as it ought to be.

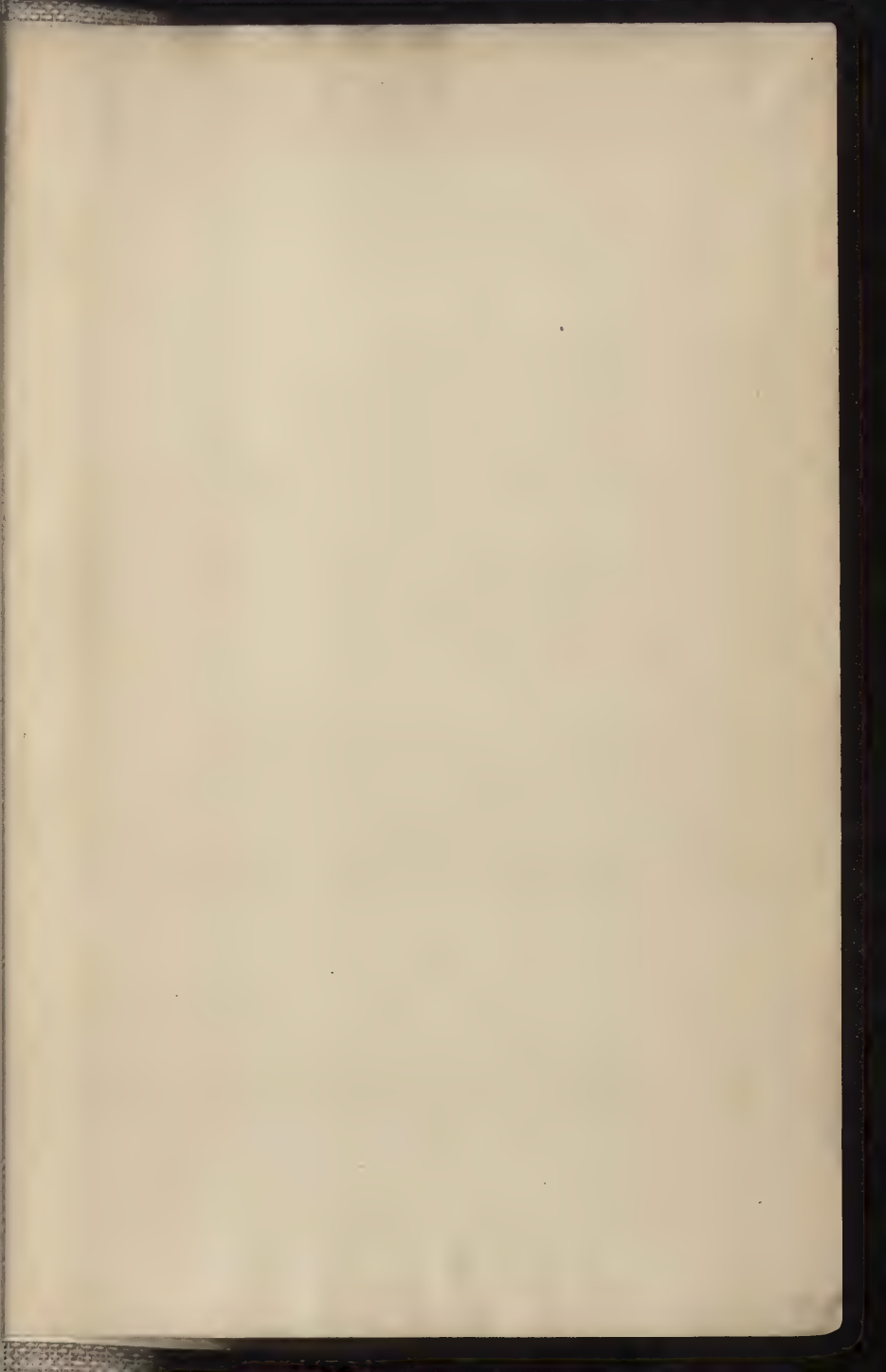
$$\text{If } AB=33 \text{ and } n=1.5; \text{ then } FE = \frac{33}{2 \times 1.5} = 11; \text{ and the area of the prism ABE} \\ = 16.5 \times 11 = 181.5.$$

Therefore the true content of the solid, limited by the parallel planes DABC, IABH, is  $(2440 - 181.5) \times L = 2258.5 \times L$ .

*Note.*—Equations 1, 2, 3, 4, 5 (p. 150 and 151) evidently give the same result as the following more general equation: viz.—

Let the middle area represented by *cabd* in *Fig. 2* or DABC in *Fig. 5*=M; and let V=volume, as before described; then

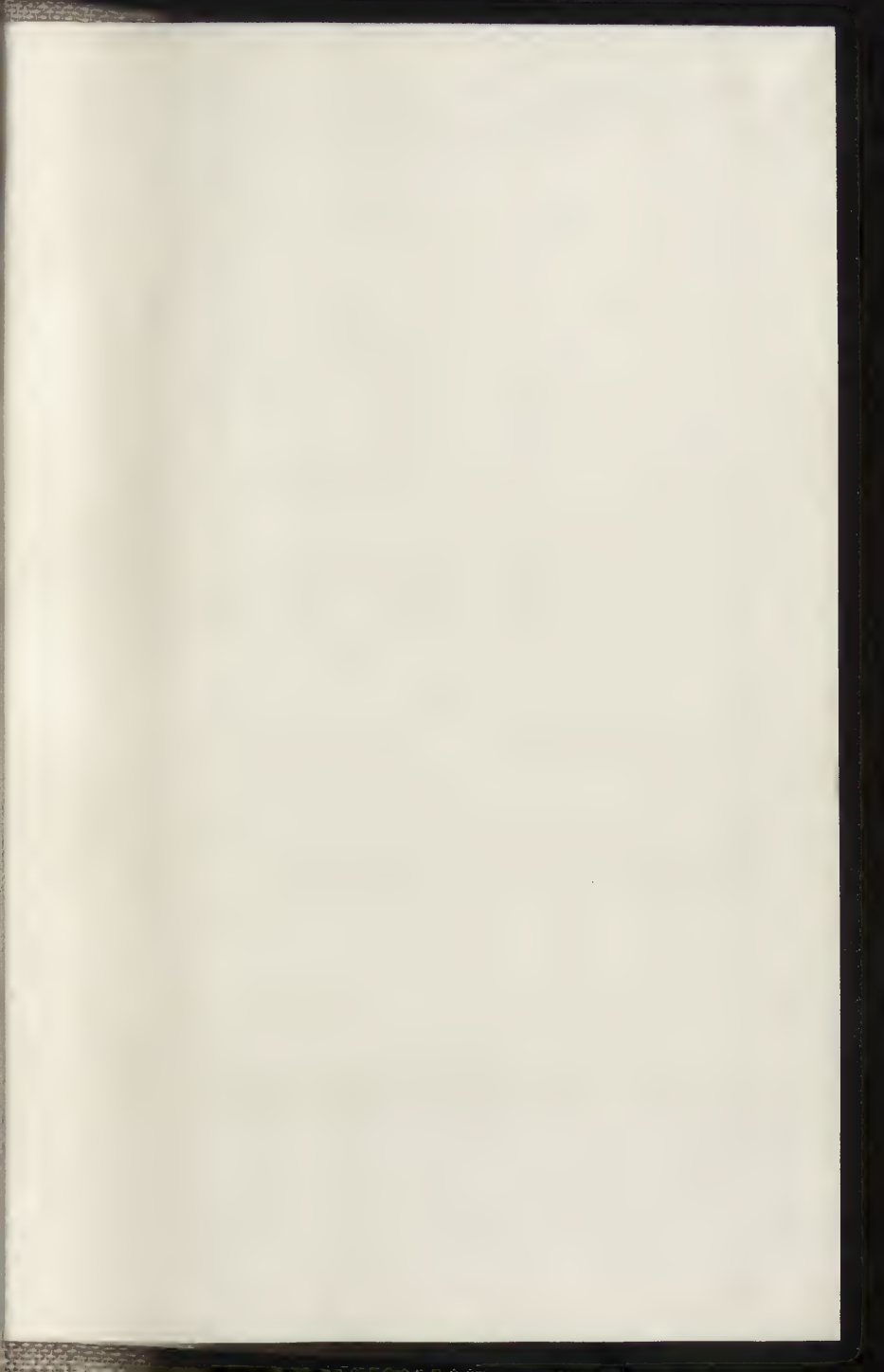
$$V = \left\{ M + \frac{n \cdot ZQ^2}{3} \right\} \times L \dots \dots \dots (8)$$



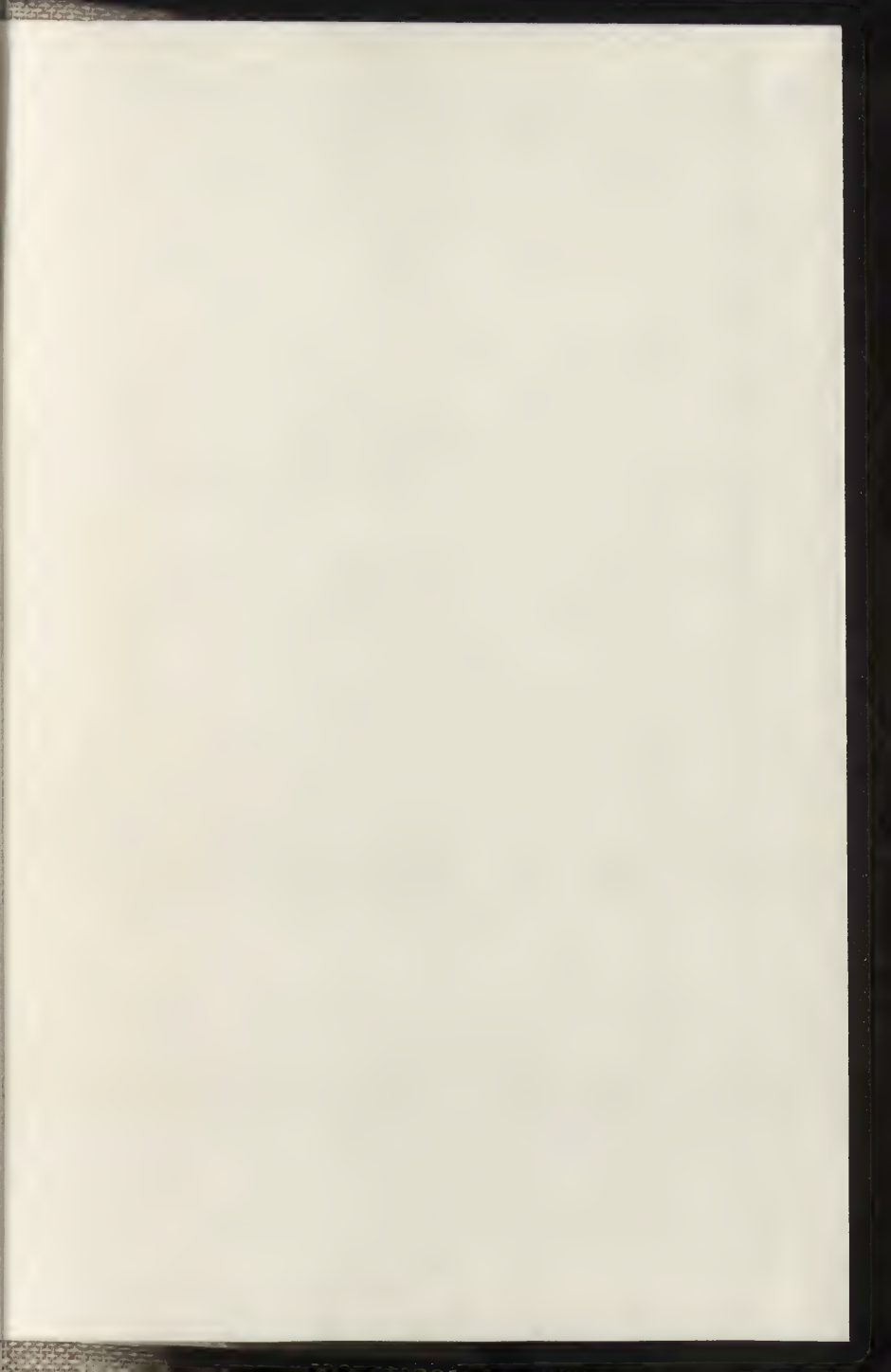
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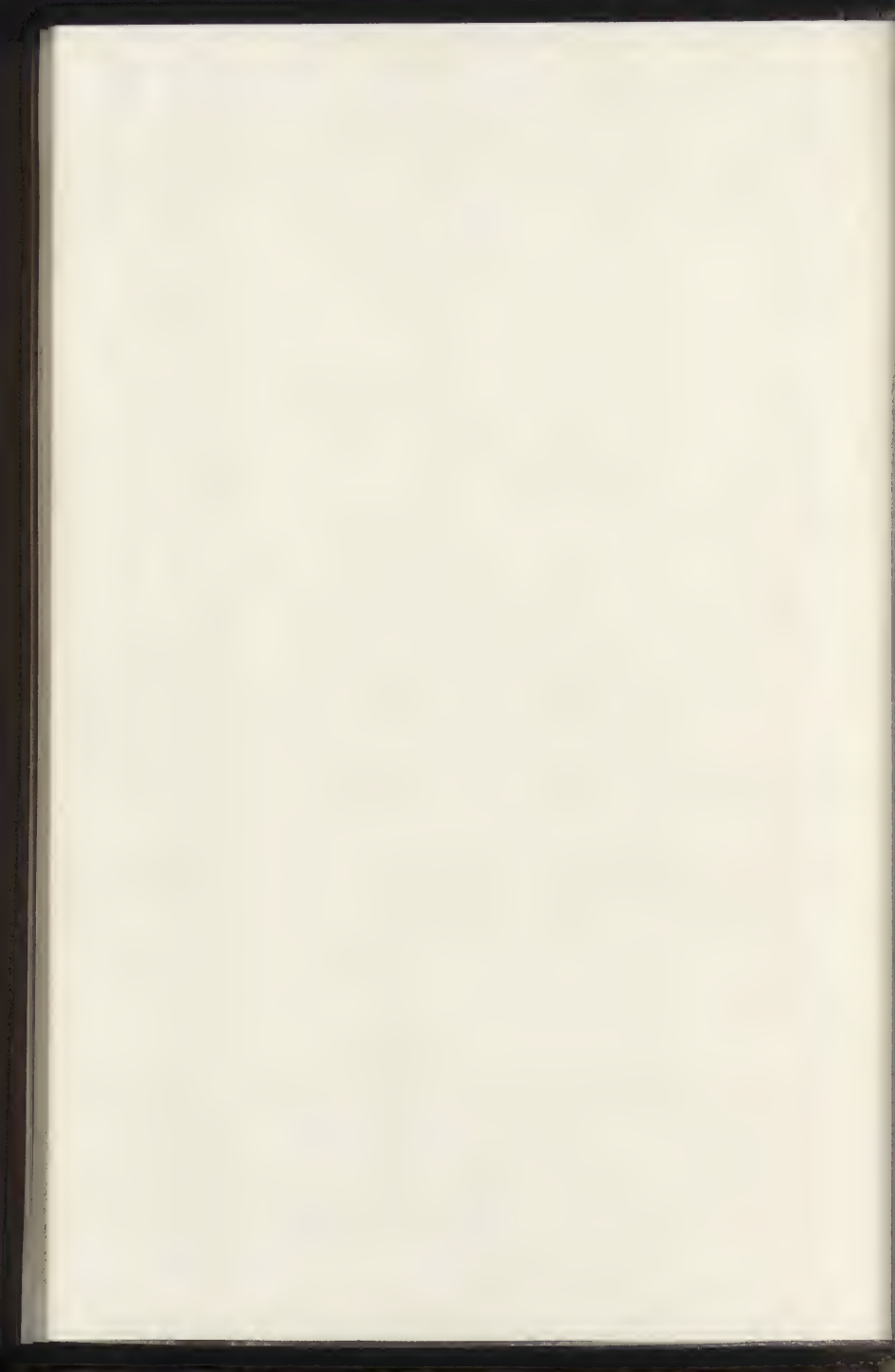
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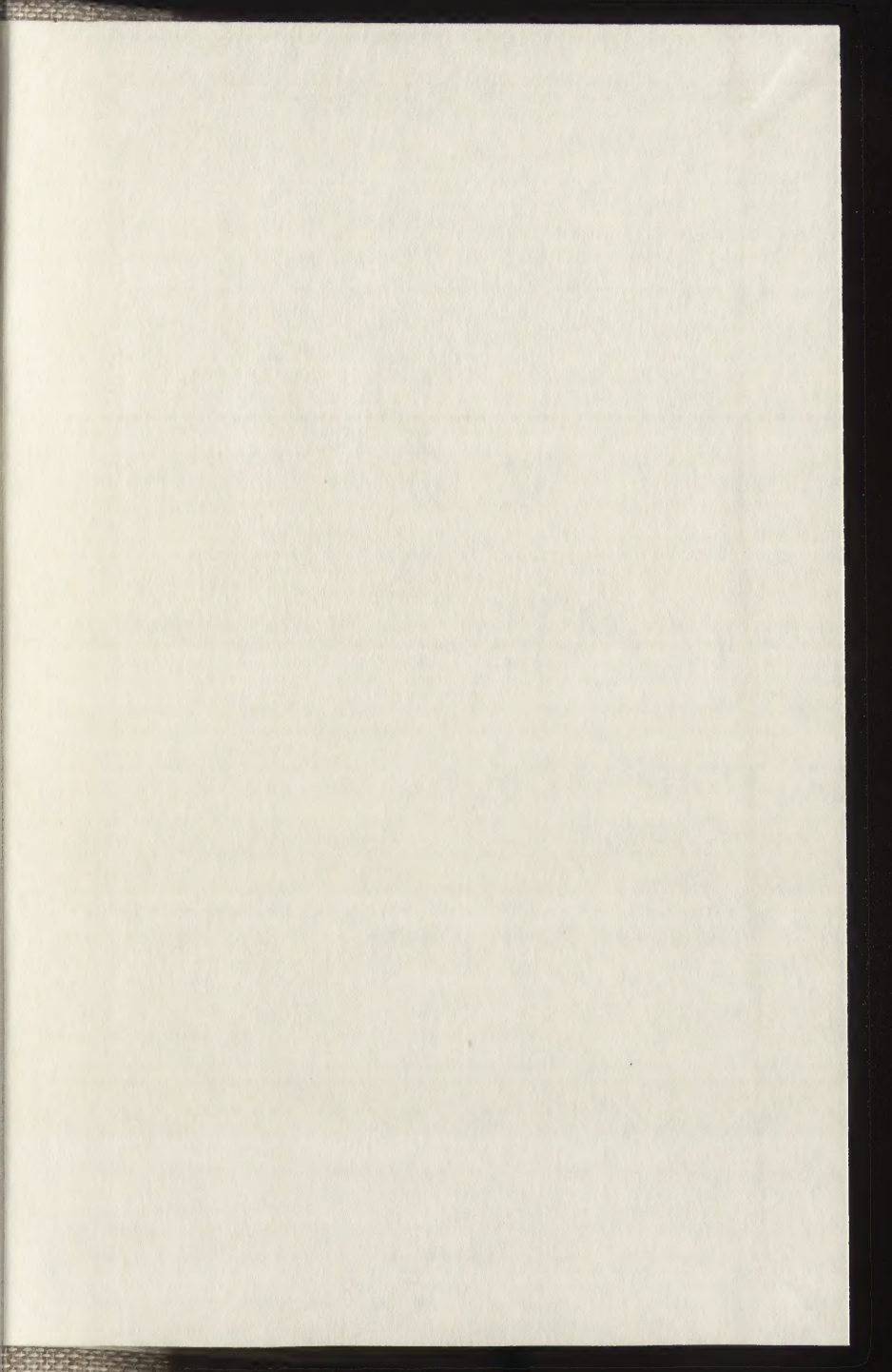
















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